THE CO-CONSTRUCTION OF COURT-MADE PATENT POLICY AND FIRM STRATEGY

A Dissertation
Presented to
The Academic Faculty

by

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In Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy in the
School of Public Policy

Georgia Institute of Technology

August 2019

THE CO-CONSTRUCTION OF COURT-MADE PATENT POLICY AND FIRM STRATEGY

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ACKNOWLEDGEMENTS

I would like to extend my sincerest gratitude to John Walsh for his passionate and lively yet patient mentorship. I would also like to thank my dissertation committee members for their guidance: Alan Marco, Gordon Kingsley, Stuart Graham, and Tim Holbrook.

Data has been particularly crucial for the completion of this project. This project was funded by a Doctoral Dissertation Research grant (#1759991) in the Science of Science and Innovation Policy (SciSIP) program at the National Science Foundation. The firm-level French Census data was provided by the Institut National de la Statistique et des Etudes Economiques (INSEE), the Direction Générale des Finances Publiques (DGFiP), the French Ministry of Higher Education, Research and Innovation and the Institut National de la Propriété Industrielle (INPI). This work is supported by a public grant overseen by the French National Research Agency (ANR) as part of the «Investissements d'avenir » program (reference: ANR-10-EQPX-17 – Centre d'accès sécurisé aux données – CASD). My work with the EPO Patstat data was greatly facilitated by Kaye Husbands Fealing and Seokbeom Kwon. In addition, I would like to thank the IT officers (Christophe Masson, Chris Kennedy, and Steve Hodges and his team), librarians (Ameet Doshi) and administrative officers at Georgia Tech and Telecom Paristech as well as John Walsh and Patrick Waelbroeck for overcoming the numerous obstacles in making the data access possible.

Lastly, I am grateful to my friends, family, and the inspiring community in the School of Public Policy and the Scheller College of Business for their support.

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AIA	the Leahy-Smith American Invents Act
CAC40	French stock market index representing a capitalization-weighted measure of the 40 most significant stocks among the 100 market caps on France's securities market (Euronext Paris)
CAFC	the United States Court of Appeal for the Federal Circuit
FTC	the Federal Trade Commission
NIH	the National Institute of Health
OECD	the Organisation for Economic Co-operation and Development
OLS	Ordinary Least Square (Regression Method)
US	the United States
USPTO	the United States Patent and Trademark Office
WIPO	the World Intellectual Property Organization

SUMMARY

The need to accommodate new technologies at an increasingly fast pace has led the judicial branch to become a key source of changes in patent policy in the United States. This dissertation examines the co-construction of patent policy and innovation strategy in the judicial branch of government. Its main contributions are to the economics of innovation literature and to the policy process literature.

A long-lasting debate on the relationship between patents and innovation has led to a multitude of studies supporting each side of the debate in the consideration of the desirability of strong patents. Nevertheless, there is still a lack of conclusive empirical evidence mainly due to methodological challenges in estimating the impact of changes in patent strength. Leveraging a shock created by the US Supreme Court, I show that the common belief that weaker patents lead to fewer innovations is incorrect (for a specific aspect of patents), while accounting for heterogeneous patent-related strategies. Using a mixed-methods approach (interviews, court documents, and census data), I find that the arguments made in court mirror the debate in the academic literature and I show that the impact on innovation is contingent on firms' characteristics and innovation strategies. Motivated by the heterogeneous impact of patent policy, stakeholders attempt to influence US Supreme Court decisions. I take advantage of this setting to address a gap in the policy process literature, which has neglected the judicial branch of government. This dissertation builds on perspectives from legal and political science literatures, examining policymaking processes in the US Supreme Court to incorporate the judicial branch of government in the corpus of policy process literature. Focusing on the role of stakeholders and how they use information strategically, I find evidence of the influence of different types of information at the two phases of the policy process, a distinction unobserved in settings considered in the existing policy process literature.

1 CHAPTER 1 INTRODUCTION

Courts have gained importance in patent policy as traditional policymaking processes (in the legislative and executive branches of government) struggle to adapt the patent system to new forms of innovation due to the increasingly fast pace of technological change. Since the 1980s, within a relatively static framework set by the two other branches of government, court rulings on legal disputes have continuously changed the strength of patents in the US. Over the past two decades, the patent policies adopted by the elected branches of government were the American Inventors Protection Act that included the 18 months disclosure in 2001 and the America Invents Act in 2011. The courts have made more frequent changes to the patent system: the Supreme Court alone has ruled over thirty patent-related cases since 2000, including decisions on the patentability of software and business methods (Bilski v. Kappos in 2010, Alice v. CLS in 2014), genes (Molecular Pathology v. Myriad in 2013), and other subjects.

1.1 Economics of Innovation

The socio-economic impact of these changes in patent strength have long been debated and are still controversial both among academics and practitioners (Arora et al., 2008; Boldrin and Levine, 2009; Budish et al., 2016; Cohen, 2005; Jaffe, 2000; Penrose, 1951; Sampat and Williams, 2019; Williams, 2017, 2016).

The idea of granting temporary exclusive rights to inventors is consistent with Schumpeterian growth theory (Schumpeter, 1928, 1942). In the Schumpeterian model, growth is generated by the repetition of a creative destruction process: new products or processes are introduced, resulting in the opening of new markets. Innovators have monopoly power in these markets until the emergence of a new product/process that is sufficiently more competitive replaces the old ones. In this dynamic framework, the opportunity to acquire monopoly power and obtain associated rents by excluding others

is necessary to create an incentive to innovate. By using intellectual property (IP) rights such as patents, policymakers trading off the deadweight loss due to temporary monopolies for the social welfare gains resulting from increased incentives to innovate. Patents help address the Arrow information paradox faced by inventors (Arrow, 1962), in which inventors need to disclose knowledge to potential technology buyers while retaining the ability to obtain compensation for the knowledge they have produced. In addition, patents are also meant to induce knowledge spillovers by disclosing patented inventions to the public. Both of these functions are expected to enhance this cycle of growth.

Although there has never been a period of real consensus among scholars and policymakers, there have been relative swings in the general attitude towards the desirability of stronger or weaker patents. Patent policy changes aspects of patent strength: the scope of patenting, the breadth of interpretation of the claims, the ability to exclude infringers from using patented knowledge (Walsh et al., 2016), and other administrative aspects. Beginning with several studies published in the 1960s that primarily focused on established firms, economists have pointed to patents' inefficiency in providing incentives to invest in R&D, including in high-technology industries (Mazzoleni and Nelson, 1998). In a period starting in the 1980s , scholars favored strong patents for the protection they provide small and medium enterprises (SME), new firms, and research organizations engaging in technology transfer (Mazzoleni and Nelson, 1998). In the policy realm, this period lasting until the 1990s was marked by events that strengthened patents in multiple ways. First, the Bayh-Dole Act adopted in 1980 facilitated universities to take ownership of patents resulting from government-funded research projects. Second, the creation of the Court of Appeal for the Federal Circuit (CAFC) in 1982 unified judicial decision-making. Additionally, several court decisions

broadened patentable subject matter in areas such as software and business methods[1] and life science[2]. As a result, the success rate of patent holders in protecting patented knowledge significantly increased (Jaffe, 2000). Around the 2000s, the increasing strength of patents generated concern among scholars, leading to an opinion shift against strong patents (Cohen, 2005; Lerner, 2002). An important concern was the barrier to knowledge due to multiple aspects including the patenting of formerly publicly available knowledge due to the Bayh-Dole Act (Nelson, 2004), the fragmentation of knowledge into several patents associated with one invention in certain scientific fields (Galasso and Schankerman, 2010; Ziedonis, 2004), the need to compete within new patent-intensive behaviors such as patent portfolio races (Hall and Ziedonis, 2001), and more frequent and costly litigation (Lanjouw and Schankerman, 2001).

With non-practicing entities such as universities, government laboratories, and private firms patenting more actively, scholars and policymakers focused their attention on firms that relied on patent royalties without commercializing inventions. Following some high-profile patent disputes that resulted in high costs for the accused infringers,[3] there was a shift from empowering patent holders against infringers (who were seen as knowledge thieves) to doubting the good faith of patent holders and the culpability of alleged infringers. The literature is divided on the harm (Bessen and Meurer 2014, Lemley and Shapiro 2007) and benefit (Mcdonough, 2006; Steensma and Chari, 2016) resulting from these non-practicing entities.

[1] Diamond v. Diehr (1981) and State Street Bank and Trust v. Signature Financial Group (1998)
[2] Diamond v. Chakrabarty (1980)
[3] Polaroid v. Kodak in 1989 and NTP, inc. v. Research in Motion in 2005

This period was marked by several decisions that backtracked the range of patentable subject matter, as some subjects were judged as having questionable boundaries and were held responsible for the increase in legal disputes. This narrative towards patent holders is likely to have influenced policy decisions, consistent with a recent remark by the Director of the United States Patent and Trademark Office (USPTO)[4] in answering a former USPTO Chief Economist's question regarding a key change needed in the patent system. These shifts are also perceived by industrial actors.

> *"First, we need a change in the dialogue about IP (intellectual property). Policy starts from there, so it is a key issue. The negative narrative in the media towards patents impacts decisions by policymakers." Andrei Iancu, Director of the USPTO (February 2019)*

> *"We can feel that this is a period of 'retreat,' of backtracking with protections that are less generous than before. It may have been excessive before, and it is perhaps becoming excessive in the other direction today." (Interview about the US patent system with the chief IP officer of a French chemical manufacturing corporation, September 2016)*

The concomitance of this shift and the increasing role of the Supreme Court in patent policy in the 2000s (Holbrook, 2013) is not a coincidence. Both the academic literature and the media[5] point out that the Supreme Court is stepping in because it perceives that the CAFC went beyond its objective of unifying the patent system and too far into strengthening patents (Groetken et al., 2008; Holbrook, 2004; Seidenberg, 2008; Shapiro, 2000). The Supreme Court believes that the "pendulum has swung too far" and

[4] "A Discussion with Andrei Iancu, Undersecretary of Commerce for Intellectual Property and Director of the United States Patent and Trademark Office" at the Scheller College of Business at Georgia Tech, February 25th 2019

[5] Example of articles in Reuters and Patentlyo: https://www.reuters.com/article/usa-court-patents/u-s-supreme-court-and-top-patent-court-rarely-see-eye-to-eye-idUSL1N1JG1ZF ; https://www.reuters.com/article/us-usa-court-patents-idUSKBN19A34I; https://patentlyo.com/patent/2014/06/judicial-hypothetical-limelight.html

goes as far as stating that the CAFC "fundamentally misunderstands what it means to infringe"[6] some types of patents.

Whether changes in patent strength will stimulate or deter innovation is still an open debate among scholars today (Arora et al., 2008; Boldrin and Levine, 2009; Budish et al., 2016; Cohen, 2005; Jaffe, 2000; Penrose, 1951; Sampat and Williams, 2019; Williams, 2017, 2016) and creates uncertainty for innovators. Studies in the economics of innovation literature have provided extensive insights supporting both sides and help us understand various mechanisms that explain changes in patenting behavior. Recent work by Heidi Williams and her co-authors point out, however, that we still have a limited understanding of what these changes mean for innovation itself and investments in innovative activities (Budish et al., 2016; Sampat and Williams, 2019; Williams, 2017). Because of the variety of ways in which innovation is produced across firms, most studies that have attempted to provide such insights have focused on particular technological areas, often pharmaceuticals. There is a need to examine the heterogeneous impact that patent policies have on different types of firms because, as demonstrated by the data in Chapter 3, different types of innovators have adverse positions and high stakes when it comes to patent policy. In addition, studies estimating the impact of changes in patent strength face challenges related to identification such as the controlling of rival hypotheses such as technical breakthrough, regulatory capture, and industry- or country-level changes (Hall and Ziedonis, 2001; Kortum and Lerner, 1999). Lastly, this literature also faces measurement issues, since publicly available archival data consist mainly in patents from which inferences and assumptions are being

[6] p. 5 in the opinion of the Supreme Court delivered by Supreme Court Justice Samuel Alito for the Limelight v. Akamai Technologies case (572 U.S. 915) in 2014

made on innovation despite the wide disparity in how patents are used. This dissertation aims to contribute to the theoretical debate on the relationship between patents and innovation by filling those theoretical and empirical gaps in the economics of innovation literature.

1.2 Policy Process Literature

In this setting, the US Supreme Court became a central policymaking actor starting in the 2000s (Holbrook, 2013). Decision-making requires legal knowledge as well as knowledge about technology and the economic strategy driving patenting behavior. This creates a situation of asymmetry of information. Stakeholders that develop cutting-edge technology and use patents in their strategy participate in Supreme Court cases, as litigants or amici (hereinafter together referred to as "stakeholders"), by presenting their arguments to the Court. Despite the risk of regulatory capture, Supreme Court Justices have incentives to rely on the information provided by stakeholders in order to understand the problems in question and make rulings that will solve them. Therefore, an additional empirical objective of this dissertation is to provide insights on the role of stakeholders and the information they provide on patent policy made in the Supreme Court.

Theories of the policy process have focused on the executive and legislative branches of government (Sabatier and Weible, 2014) and have largely ignored policymaking by the judicial branch, even though courts were acknowledged as policymakers as early as the 1950s by legal and economic scholars (Dahl, 1957; Epstein et al., 1989; Gely and Spiller, 1989; McCubbins et al., 2005, 1994a). In an article on the influence of stakeholders and expert information on government, some of the central scholars in the policy process literature dismiss the courts as irrelevant. In their view, settings in which stakeholders attempt to influence the government's decisions through

decision-making include "legislative committees and subcommittees, courts, executives, and administrative agencies" (Weible et al., 2010, p.525). However, the courts are not viewed as a setting in which "substantive" policymaking occurs because "courts usually resolve procedural issues not substantive disputes" (Weible et al., 2010, p.525).

In addition, while there is a popular belief that courts are apolitical and impartial, the legal and political science literature unequivocally rejects this naïve belief regarding the Supreme Court. Given that Justices are appointed by presidents who have strong political orientations and policy agendas, it is not surprising that the Justices' behavior also reflects some policy preferences (Dahl, 1957; Martin and Quinn, 2007; Segal and Spaeth, 2002). Nevertheless, this may explain the lack of focus on the judicial court in theories of the policy process (Sabatier and Weible, 2014).

Regardless of the reason, the policy process literature has not sufficiently considered the courts. The policy process has been described as being composed of two key phases: agenda setting and policymaking.

Agenda setting is an important step in the policy process: "Choosing among problems is the greatest dilemma facing any government" (Baumgartner and Jones, 2015, p. 40). Agenda setting by a governmental organization involves identifying a situation as a problem that the organization has a role in addressing (Kingdon, 1995). The governmental organization's action is determined by this step in which it chooses issues for which it will allocate its attention (Jones and Baumgartner, 2005).

The policymaking phase consists of searching and choosing among alternative solutions to solve a problem (Kingdon, 1995). Policy problems are often relatively complex. As a result, a significant amount of information and a high level of expertise are needed (Baumgartner and Jones, 2015; Moe, 1995). Policy problems are also

complex in the sense that solutions adopted are likely to impact multiple groups of stakeholders. As a result, given that policymakers have resources and cognitive limitations in collecting and processing the adequate information and that stakeholders have incentives to influence the outcome of policymaking, stakeholders provide information to policymakers when the policymaking process allows it. While there is a risk of regulatory capture in using information provided by stakeholders driven by private interests, there are clear benefits for the policymakers in having monitoring costs subsidized; when several competing entities monitor an issue, they provide higher-quality information at lower costs (De Figueiredo et al., 1999).

While these two phases are often conceived of as consecutive, the difficulty in obtaining sufficient information to understand a policy problem creates a "chicken and egg" situation. In order to understand the problem sufficiently to decide whether it should be an agenda item, information is needed. However, collecting information is costly, and the resources required to collect it are allocated only if the situation is identified as an important enough problem and is therefore on an agenda. Consequently, both phases often occur in a simultaneous manner and problems are sometimes identified as agenda items because available solutions receive attention first (Baumgartner and Jones, 2015; Cohen et al., 1972; Kingdon, 1995). This simultaneity creates a challenge in obtaining empirical evidence for the factors that influence each phase.

Both phases of the policy process have been examined extensively in the policy process literature. Theories including the punctuated equilibrium theory (Baumgartner et al., 2014; True et al., 1999), theories of policy learning (Jenkins-Smith and Sabatier, 1993; Nelson et al., 1987; Sabatier, 1988; Weiss, 1977, 1993, 1980), and the advocacy coalition framework (Jenkins-Smith et al., 2015; Weible, 2007) have provided

conceptual frameworks with which to consider the role of stakeholders and information in the policy process. Recent work by Baumgartner and Jones (2015) has discussed the role of two types of information at each phase. The authors define the notion of entropic information as having high diversity in content supported by various sources. This type of information is viewed as useful at the agenda setting phase, as it gives policymakers a comprehensive view from which to better choose problems on which to focus. Expert information, on the other hand, is more useful at the policymaking phase so that informed decisions can be made about complex problems and alternative solutions to adopt the best policy.

Baumgartner and Jones (2015) point out the lack of empirical evidence in this area and undertake steps to fill this gap using extensive historical data at the local, state, and federal budget levels. However, the study is not able to overcome the traditional issues faced by most studies examining the role of stakeholders and information in policymaking in isolating causal mechanisms (de Figueiredo and Richter, 2014; Keim and Baysinger, 1988) because it relies mainly on sets of budget data in the elected branches of government. Limitations arise when policy outcomes are linked to stakeholders' activities that are only partially observable. Empirical evidence on the relationship between stakeholders and policymakers suffers from traditional challenges, which are applicable broadly to the policy literature but also non-market strategy studies in the management literature. Isolating causal mechanisms and providing empirical evidence proves difficult (Baumgartner and Jones, 2015; de Figueiredo and Richter, 2014; Keim and Baysinger, 1988). Some of the key reasons are related to the fact that the overwhelming majority of studies focus exclusively on the executive and legislative branches of government in which: 1) there is little variation in the lobbying expenditure of firms that lobby and certain types of benefits, such as government contracts providing

stable benefits over time; 2) the probability of having omitted variables is significant given that interactions in terms of frequency and content are not fully disclosed and outcomes of various types are difficult to measure and compare; and 3) policies often aggregate decisions on multiple aspects and it may be difficult to tie the results to lobbying actions.

When policy is made through the judicial branch, one or a small number of entities can bring an issue to the policy agenda by starting a lawsuit; this process moves quickly relative to traditional policy processes (Sabatier and Weible, 2014). For contentious cases, the parties can petition the Supreme Court. Like other policymaking settings, the Supreme Court has discretion over accepting the issue on their agenda (grant of *certiorari*). Stakeholders other than the litigants can also influence these decisions. Chien (2010) finds that the existence of an amicus brief has a significant positive effect in the petition phase. In addition, participating in the policy process in court presents a lower barrier of entry than lobbying in other branches of the government, since participating as an amici requires less than USD20,000 (Caldeira and Wright, 1988; Chien, 2010). This process is somewhat adapted to the multiple-stream theory that explains the policymaking process as actors taking advantage of a policy window (a lawsuit) to bring a problem to light and bring proposed solutions to the attention of the decision-makers (the Supreme Court) (Kingdon, 1995). A key difference is that the policymaker is not free to choose from any problems, as there are a limited set of problems (petitions) compared to those considered by the elected branches of government, which are free to address any issue.

Once an issue is on the policy agenda, policymakers design a solution and stakeholders advocate for their interests. In this phase, scholars have focused on the risk and existence of situations of capture that could lead to suboptimal policies. Given that

individuals and organizations have a bounded rationality and diverse objectives, amicus briefs are rarely neutral and are instead a tool of advocacy (Krislov, 1963). In this phase, similar to the elected branches of government, Supreme Court Justices as policymakers can be faced with a wide variety of arguments and stakeholders through party and amicus briefs. However, the key difference is that while the arguments supporting their final decision can be diverse, the set of policy choices is much more restricted than in the elected branches of government. The Supreme Court rules in favor of either the petitioner(s) or the respondent(s). This decision is not simply binary, as the argumentation in the opinion can provide nuance in how the Court recommends enforcing their decision. Nevertheless, the set of policy solutions that can be adopted to solve problems on their agenda is limited relative to those considered by the elected branches of government.

This dissertation extends a theory of the policy process (Baumgartner and Jones, 2015) focused on the role of stakeholders and information to the judicial branch of government. In addition, the dissertation makes an empirical contribution to the policy process literature by taking advantage of the particular features of the policy process in the Supreme Court, such as the clear separation of the two phases and the observability of interactions between stakeholders and policymakers.

To achieve this objective, I rely on the legal and political science literature that provide extensive insights on the agenda setting phase (among others: Black & Owens, 2009; Caldeira & Wright, 1988) and the policy selection phase (among others: Johnson, 1997; Segal and Spaeth, 2002) in the Supreme Court. Scholars have examined factors that affect those two phases, such as the Justices' preferences (Baum, 1977; Harvey and Woodruff, 2013) and the influence of stakeholders as litigants (Black and Boyd, 2012) and as amici (Paul M Collins, 2007; Spriggs and Wahlbeck, 1997). Scholars have also

studied the role of information brought by these stakeholders in Supreme Court decisions (Cameron et al., 2000; Larsen, 2012; Spriggs and Wahlbeck, 1997). This literature provides abundant insights on which to build a theory of the policy process in the judicial branch of government. However, the legal and political science literature overlooks the nuances in how different types of information are likely to influence the Justices. Therefore, the dissertation also aims to contribute to the legal literature.

To provide a deeper discussion of the role of stakeholders and information, I rely on other streams of the literature that have examined the mechanisms through which stakeholders can influence policymakers' decisions using information. In the policy learning literature, information is first thought as "informing" or "enlightening" policymakers. To alter policymakers' beliefs, this influence is likely to occur through a continuous accumulation of evidence over long periods of time (Daviter, 2015; Sabatier, 1978; Weiss, 1977). Insights from the social movement literature indicate that expert information can have a significant effect on skeptical decision makers (Ganz and Soule, 2019). Politicians need to rely on experts in the natural and social sciences to save costs in acquiring the knowledge and monitoring new information given the breadth and uncertainty of complex policy issues (Moe, 1995). According to the well-established organizational learning literature, when there is information asymmetry, political coalitions can use information as a source of institutional power (Cyert and March, 1963; March, 1962). Therefore, better-informed stakeholders may use information strategically to shift policymakers' attention and reframe policy problems to their advantage (Daviter, 2015; Jones and Baumgartner, 2005). Policymakers, particularly the Supreme Court, have incentives to make decisions that are perceived as legitimate. As a result, legitimacy is a resource that allows stakeholders to obtain more influence on the attention of policymakers (Deephouse et al., 2017; Jia, 2017; Jia and Mayer,

2015; Suchman, 1995). This dissertation unpacks the effect of using information as knowledge and as a source of legitimacy.

1.3 Goals of This Dissertation

This dissertation has four primary objectives. First, the dissertation aims to improve our understanding of the recent phenomenon of patent policymaking in the Supreme Court. The empirical understanding of this phenomenon is important for policymakers and stakeholders that have an interest in innovation and patents.

A second key objective of this dissertation is to contribute to the innovation strategy literature by improving our understanding of the heterogeneous impact of patent policies of different stakeholders. There is still controversy regarding the impact of the strength of patents on innovation. The debate has been stymied by difficulties in understanding the effect of various facets of patent policy. I focus on the impact of a major change in patent policy made by the Supreme Court. I propose an empirical strategy to overcome the potential endogeneity issue from stakeholders' participation in influencing the decision. In addition, I examine the flurry of insights in the existing literature on patent strength in light of the arguments made by stakeholders during the process of making this policy decision. This part of the dissertation improves our understanding of how courts shape the patent system by (1) examining the heterogeneous impact of these decisions on the rate and direction of firms' innovative activities and (2) showing the incentives to influence the direction of patent policy motivated by this heterogeneity.

A third key objective is to provide a starting point for incorporating the judicial branch of government in the corpus of policy process literature. Focusing on the theory by Baumgartner and Jones (2015) that explains the role of different types of information at different phases of the policy process, I discuss its generalizability to policymaking

in the Supreme Court by relying on existing insights from the legal literature. By conducting this exercise and using insights from the policy learning literature, the social movement literature, and organizational learning theory, this dissertation also introduces some nuance in the view proposed by Baumgartner and Jones (2015) on the role of information in the policy process.

Lastly, the fourth key objective of the dissertation is to provide empirical evidence supporting or refuting the above theoretical contribution in a way that overcomes the traditional empirical challenges laid out earlier. This dissertation presents the context of patent-related Supreme Court cases over 2000-2015 as a setting that provides multiple advantages to accomplish that objective. Exchanges of information between stakeholders and policymakers are observable and recorded in the format of court briefs, as opposed to mostly unobservable interactions through lobbying in the legislative and executive branches. In addition, the relatively standardized format of legal precedent citations and citations of other external documents in stakeholders' briefs and the Supreme Court *opinion* rendering the final decision provide a unique opportunity to track whether information provided by participants affects the final decision. Some of the other key advantages of this setting are that patent decisions have remained so far relatively apolitical (Sag et al., 2009), so focusing on patent policy allows the observation of the role of influence beyond party affiliation. An additional advantage is the ability to distinguish three policy topics regarding patent strength (patentability, breadth of claims, and ability to exclude), which are stable over time.

This dissertation is organized as follows. First, Chapter 2 serves as a primer on policymaking in the Supreme Court. This chapter presents the process of case review in the Supreme Court as well as the archival records on each of these cases. This chapter aims to familiarize the reader with the data and empirical setting used throughout this

dissertation to support theoretical contributions with empirical evidence, in order to be able to engage more deeply throughout the rest of the dissertation.

Next, Chapter 3 is grounded in the literature on the relationship between patent strength and firm innovation, and focuses on how patents' provision of the ability to exclude affects the rate and direction of innovation. This chapter provides theoretical and empirical insights on the long-debated relationship between patent strength and innovation. Leveraging a shock created by the US Supreme Court, it challenges the view that weaker patents lead to fewer innovations. To confront theories in the existing literature predicting changes in firm strategy leading to both increases and decreases in innovation, a mixed methods approach is used. I combine the analysis of court documents with quantitative estimations of the impact using a panel data set of patent and firm data to examine the mechanisms behind patent policymaking and firm strategy. I show that the common belief that weaker patents lead to fewer innovations is unfounded, while accounting for the heterogeneous patent-related strategies.

Motivated by Chapter 3, in Chapter 4 I examine the relationship between stakeholders who have incentives to influence patent policy and the Supreme Court's decisions in the two phases of the policy process: agenda setting and policymaking. I focus on the effect of different types of information conveyed by the stakeholders to the policymakers and examine how their effect compares to the predictions made by Baumgartner and Jones (2015) based on settings traditionally considered by the policy process literature. I find that expertise is used to influence policymakers by providing legitimacy to a position, as opposed to influencing policymakers by enlightening them through expert knowledge.

The concluding chapter, Chapter 5, discusses the key findings of this dissertation and its theoretical, empirical and methodological contributions as well as managerial and policy implications.

2 CHAPTER 2 PRIMER ON POLICY PROCESS IN THE COURT

This chapter discusses the Supreme Court (henceforth also referred to as "the Court"), how it functions as an organization in the judicial system, as well as the Court's relationship with other branches of government as a policymaker.

2.1 Role of the Supreme Court in a Tripartite Government

In theory, the US government is composed of three co-equal branches to separate executive, legislative, and judiciary power and to form a system of "checks" and "balances" to safeguard democracy. In practice, however, several aspects contribute to the perception of the judicial branch as the weakest or "least dangerous" branch (Hamilton et al., 1788). The Court's jurisdiction and the number of Justices are not stated in the Constitution and can be modified by the elected branches of government. Another well-known interdependency is that the Supreme Court can rule on laws or actions taken by the two other branches of government if they are not constitutional. However, the court cannot initiate any action; it can only respond to cases that stakeholders bring to the court. Additionally, as head of the executive branch, the president appoints the Justices with the consent of the Senate.

The power that allows the Supreme Court to make policy is called "judicial review." This power gives the Court the power to examine and possibly invalidate the actions of the executive and legislative branches of government both at the federal and state levels.[7] Using this power, the Court can also rule to decide how laws should be interpreted by lower courts in order to enforce policies uniformly across the nation.

As the highest court in the judicial branch, the power of the Supreme Court to rule on cases is established by the Constitution. However, the concrete organization of

[7] Source: https://www.law.cornell.edu/wex/judicial_review

the ways in which the Supreme Court rules on cases was established by Congress in the Judiciary Act of 1789. Initially, the Judiciary Act limited the Supreme Court's powers to examining whether government officials are abiding by the law.[8] The Supreme Court granted itself judicial review power in the Marbury v. Madison decision in 1803.

The Supreme Court can use its powers to review congressional laws (statutes), state actions (by relying on the Supremacy clause in the Constitution), federal bureaucratic agencies, and presidential actions. As a result, the Marbury v. Madison decision allowed Judges to make laws in areas that overlap with the executive and legislative branches of government. In practice, however, the Supreme Court is reluctant to taking actions that could be perceived as political, such as interfering with statutes and with presidential actions, especially on national security issues. While the power of judicial review was not included in the US Constitution, its desirability was expressed by some of the Constitution's authors:

> *"A Constitution is, in fact, and must be regarded by the judges, as a fundamental law. It therefore belongs to them to ascertain its meaning, as well as the meaning of any particular act proceeding from the legislative body. If there should happen to be an irreconcilable variance between the two, that which has the superior obligation and validity ought, of course, to be preferred; or, in other words, the Constitution ought to be preferred to the statute." Alexander Hamilton, Federalist No. 78* (Hamilton et al., 1788)

Using the power of judicial review, the Supreme Court makes laws by setting precedents. Decisions made by the Supreme Court are binding to lower courts. Therefore, the Supreme Court is able to make laws by setting precedents without re-writing laws made by the other branches of government. These precedents are only binding in court, not in the executive or legislative branches. Nevertheless, they do signal how the courts will rule if their decisions are involved in a dispute in court.

[8] Source: https://www.uscourts.gov/about-federal-courts/educational-resources/about-educational-outreach/activity-resources/about

The Supreme Court does not have enforcement power. As a result, it is possible for a president to refuse the orders of the Supreme Court, which occurred for example in Worcester v. Georgia, 31 U.S. (6 Pet.) 515 (1832). While such disregard for a Supreme Court decision has become highly unusual, this organizational structure makes the Supreme Court dependent on its legitimacy in the perception of the public and the elected branches of government. The Court aims to be viewed as impartial, and therefore independent from the other branches and their political partisanship, as decisions should be enforced regardless of the party in power. Therefore, decisions have to be supported with legitimate arguments because public perception may influence whether the elected branches of government are willing to enforce the Court's decisions (Baum, 1977; Epstein et al., 1989; Gely and Spiller, 1989; McCubbins et al., 2005, 1994b; Spiller and Gely, 1992; Spiller and Tiller, 1997).

Court decisions follow the principle of "stare decisis," which means to "let the decision stand." This principle also means that while the Supreme Court can change precedent, it must justify any departure from the status quo. Therefore, the Supreme Court is to a certain extent constrained by its own precedents.

2.2 Role of the Supreme Court in the Judicial System

The Court system in the judicial branch of government is hierarchical. The US Supreme Court is the highest court of the judiciary, which is also comprised of federal courts and districts courts referred to as "lower courts" in comparison. Disputes that are brought to court can be handled on either the federal side or the state side. I focus on the Federal side that has jurisdiction over cases in which the law at issue is a federal law, treaties, or the US Constitution. Cases dealing with intellectual property issues fall into this category. The first level of courts on the Federal side is made of ninety-four US District Courts. The ruling of a US District Court can be appealed in a US Court of Appeals. In

this second level, the federal appeals courts are called circuit courts, and decisions in circuit courts are made by a panel of three judges. Twelve circuit courts are distributed regionally. Patent cases are handled by the Court of Appeals for the Federal Circuit (CAFC). Rulings of the federal courts of appeals can be appealed in the Supreme Court.

Cases handled by the judicial system represent a small proportion of all legal disputes. Examining the proportion of cases that are dropped among federal civil trials in 2002, Galanter (2004) found that about 1.8 percent of the cases were resolved by a court decision. Among patent cases over the period 2005-2010, 4.2% of the cases reached trial (Cotropia et al., 2017).

2.3 Key Characteristics of the Supreme Court

The Supreme Court is the highest court in the judicial system. Since 1869, the Court has been composed of eight associate Justices and one chief Justice. All Justices are nominated by the sitting President and confirmed by the Senate. Nominations are therefore made along party lines with strategic considerations for the orientation of the Justices already on the court and the constraints imposed by the Senate's response (Moraski and Shipan, 1999). Once approved, a Supreme Court Justice is appointed for life.

The topics that have been tackled so far in Supreme Court cases can be categorized[9] into: attorney-related issues (e.g. disbarment, fees), civil rights (e.g. Constitutional, State jurisdiction, desegregation, employment discrimination, voting), criminal procedures (e.g. death penalty, discovery, jury instructions, firearms), due process (e.g. jurisdiction, prisoners' and defendants' rights), economic activity (e.g. antitrust, consumer protection, intellectual property, mergers, environmental protection,

[9] Categories used by www.oyez.org, website jointly created by the Cornell's Legal Information Institute (LII), Justia, and Chicago-Kent College of law archiving and making the archive of the Supreme Court of the United States publicly available.

regulation of public utilities), federal taxation, federalism (e.g. federal-state ownership dispute, natural resources, pollution), First Amendment, interstate relations, judicial power, privacy, and unions. Rules governing the process of reviewing cases are detailed in a document entitled "Rules of the Supreme Court of the United States" (Supreme Court of the United States, 2017) written and updated[10] by the Supreme Court since 1845.

Cases are brought by litigants that petition the Supreme Court to review their case. When litigants petition for a *writ* of *certiorari,* they are asking the Supreme Court to agree to direct an inferior court to send the record for a case and conduct a judicial review. In addition to the petition, three other briefs can be filed by the litigants but are not mandatory. First, the respondent(s) can file a "brief in opposition," arguing for a denial of the petition. They are expected to argue against the petition and also "address any perceived misstatement of fact or law in the petition" according to Rule 15 (Supreme Court of the United States, 2017). Briefs in opposition to a petition are compulsory only in death penalty cases. Second, the brief in opposition can be followed by a response by the petitioner in a "reply brief for the petitioner(s)." Third, the respondent(s) can answer as well in a document called the "reply brief for the respondent(s)."

Rule 10 (Supreme Court of the United States, 2017) determines the rules for selecting cases to review. The language of the rule is not clear-cut and explicitly leaves room for discretion on the Justices' part: "review on a writ of *certiorari* is not a matter of right, but of judicial discretion." Nevertheless, Rules do emphasize some aspects of procedures, including the fact that petitioning the Supreme Court should be a "last

[10] Rules are not updated in a systematic way. They have been updated six times since 2000 and were updated three times in the 1990s.

resort." Litigants should have already exhausted all the appeals at the district-level and federal-level courts. In addition, Rule 10 recommends reviewing cases in which lower appellate decisions present a conflict (Black and Boyd, 2012). This means that one of the high-level objectives when reviewing a case is to improve certainty and consistency in the law (Baum, 1993). In addition, the question must be "an important question" according to Rule 10 (Baum, 1993; Black and Boyd, 2012). Cases are accepted if four or more Justices are in favor of placing the issue on the Court's agenda (sometimes referred to as the Rule of Four). The Court has no obligation to justify its decision at this phase.

The number of cases that make their way in the judicial system up to a petition of the Supreme Court is between 7,000 and 8,000 cases per term.[11] About a hundred of such cases were argued and decided each term over the period 2000-2015 (Table 1). Some petitions may be accepted but not argued if they are vacated in the grant, vacate, remand order (GVR order) due to a change in the legal circumstances such as a confession of error or a change in the law. Among cases that are decided in the Supreme Court, less than 2% are patent-related.[12] The number of patent-related cases that the Supreme Court hears seems to be increasing compared to the number of such cases reviewed each year historically (Salmon, 2017).

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[11] Source: https://www.supremecourt.gov/about/justicecaseload.aspx

[12] Patent-related cases were identified by selecting all Supreme Court cases that include the keyword "patent." This list of cases was then narrowed down based on the case description in the Supreme Court opinions. Cases in which patents are mentioned but the issue at stake is unrelated to patents were excluded. The excluded cases were double-checked using the description of the case on www.oyez.org (website jointly created by the Cornell's Legal Information Institute (LII), Justia, and Chicago-Kent College of law archiving and making the archive of the Supreme Court of the United States publicly available) and using the list of patent-related cases provided on writtendescription.blogspot.com/p/patents-scotus.html (Blog on patent news and scholarship managed by Lisa Ouellette, Associated Professor at Stanford Law School, Michael Risch, Professor of Law at Villanova University and Camilla Hrdy, Assistant Professor of Law at the University of Akron School of Law)

Table 1 Cases decided at the Supreme Court (term starting)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
All cases decided	137	137	135	121	121	121	121	122	121	120	117	116	116	115	76	72
Patent cases decided	0	2	2	0	0	1	2	3	1	1	1	3	3	4	6	3

Source: www.oyez.org

Stakeholders trying to trigger a policy change by placing their problem on the Supreme Court's agenda are the petitioner(s) and the amici arguing in favor of the petitioner(s). The respondent(s) and their advocates argue in favor of a rejection of the petition by the Supreme Court in order to maintain the lower court's decision. The lower court's decision is not necessarily the status quo. Arguments made in the Supreme Court often reach beyond the nature of the case before the court because the Supreme Court is not a court of error correction.

The meaning of a denial of petition for a writ of *certiorari* cannot be interpreted in a consistent way, and the action of denying itself does not create a binding precedent. In some instances, the Supreme Court may deny a case because there is no need to modify the ruling made by the lower court. However, not all denials should be considered as an approval, as the Supreme Court points out in the case Missouri et al. v. Jenkins et al. (docket number 93-1823 in 1995). In addition, a denial is not an indication of the merits or demerits of a case, as stated by the Supreme Court in the case Maryland v. Baltimore Radio Show, Inc (338 U.S. 912).

If a case is granted a writ, the Supreme Court will review the case. Once a case is on the agenda of the Supreme Court, two briefs are always filed by the parties involved: a brief by the petitioner(s) must be filed within 45 days, after which the

respondent(s) has 30 days to file a brief in response. The two briefs can be followed by an additional but optional reply brief by the petitioner(s) and a reply brief by the respondent(s).

Entities that are not parties in a case on the Supreme Court's discussion list can participate as amici curiae (often referred to as simply "amicus"/"amici"), meaning "friend(s) of the court." Entities that wish to argue in that capacity can file an amicus curiae brief (often referred to as simply "amicus brief") with the consent of the party they support, at both the *certiorari* phase and the *merits* phase. Federal and state governments are not required to obtain this permission. Occasionally, the Court invites an amicus brief from the Solicitor General or an administrative agency. Rule 37 indicates that "an amicus curiae brief that brings to the attention of the Court relevant matter not already brought to its attention by the parties may be of considerable help to the Court." In addition, parties sometimes ask other entities to support their position with an amicus brief. Amici that have participated in the *certiorari* phase are under no obligation to participate in the *merits* phase. New amici can participate in the *merits* phase without having participated in the *certiorari* phase. The average number of amicus briefs and amici per case over 2000-2015 (Table 2) shows no clear temporal trend in amici participation.

Table 2 Average number of amicus briefs and amici per case at the Supreme Court

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Amicus briefs per case	N/A	10.0	20.5	N/A	N/A	20.0	28.5	26.0	31.0	0	75.0	30.7	16.0	28.0	20.3	15.3
cert phase	N/A	2.5	6.0	N/A	N/A	3.0	5.5	4.0	7.0	0	10.0	9.3	3.0	5.0	5.3	2.7
merits phase	N/A	8.0	14.5	N/A	N/A	18.0	23.0	22.7	25.0	0	65.0	21.7	13.3	23.0	15.2	13.3
Amici per case	N/A	11.0	57.0	N/A	N/A	43.0	124.0	68.0	52.0	0	155.0	135.7	33.7	119.8	71.3	50.0
cert phase	N/A	3.0	19.0	N/A	N/A	3.0	29.5	12.7	17.0	0	11.0	56.3	5.3	53.3	26.0	4.7
merits phase	N/A	8.5	38.0	N/A	N/A	41.0	94.5	56.0	36.0	0	144.0	79.7	28.7	66.5	45.5	46.0

The Justices can be assisted by clerks in reviewing documents. Associate Justices are allowed up to four clerks and Chief Justices can have up to five. Clerks are recent law school graduates that were at the top of their class. They usually serve for one or two years. Justices can decide whether to place their clerks in the cert pool and cases are assigned randomly among those clerks. For clerks of Justices who participate in the "cert pool," a standard task is the review of the numerous petitions for *certiorari* to write memos summarizing the case. The legal literature finds that their influence on decisions is modest overall (Bonica and Chilton, 2019). Nevertheless, they can be influential in some legally significant or close decisions (Bonica and Chilton, 2019).

Once the Supreme Court has reviewed the documents on a case, a date is set for the oral arguments of the parties involved. Amicus curiae very rarely make oral arguments. Oral arguments are meant to "emphasize and clarify the written arguments in the briefs on the merits" (Rule 28). In addition, Rule 28 indicates that the litigants can assume that the Justices have read the briefs and discourage litigants from reading a "prepared text." In practice, oral arguments last 30 minutes for each side and most of the time is spent answering the Justices' questions. There is no clear rule regarding interactions during oral arguments, and the Justices' speaking time is not evenly allocated. Justices Clarence Thomas, for example, is well-known to participate only in very rare occasions.

Rulings are made through voting; each of the nine Justices have one vote. In order for a decision to be official and binding, five out of nine Justices must agree on at least one argument that either "affirms" or "reverses" the lower court's decision. This part of the decision is the one element that is binding as jurisprudence. The Supreme Court also decides on the consequence for the ruling of the lower court in the focal case. The Supreme Court can "vacate" it, which means making that judgement legally void,

and order to "remand" the decision, which means sending back the issue to the lower court for a new trial. This occurs mainly when the court has decided to overturn, and the lower court's ruling is "reversed and remanded."

The rulings of the Supreme Court are called opinions and are delivered in writing. There is no difference between a unanimous opinion and a non-unanimous opinion in the extent to which they are binding for lower courts and for future decisions of the Supreme Court. Nevertheless, unanimous opinions, which represent about 36% of all decisions (based on the period 2000-2017) (Tuberville and Marcum, 2018), are perceived as stronger precedents (Davis and Reynolds, 2006). For example, scholars have found that unanimity can influence relations between the Court and the legislative branch: unanimous decisions reversing federal statute(s) are less likely to be met with counteractions by Congress (Meernik and Ignagni, 1994). Goldman (2006, p.219) argues that:

> *"…a consensually decided case indicates that 'objectively' the case situation (either because of clear-cut precedent, or the straight-forward applicability of the statute, or constitutional provision to the facts of the case) offered little leeway for the judge and that institutional pressures inhibited an outcome other than that achieved."*

Many cases are not decided unanimously because the court is ideologically divided: 63% of cases between 2000 and 2017 were not decided unanimously (Tuberville and Marcum, 2018). In such cases, the main opinion is written by the majority, and the Justices on the losing side of the case can write a dissenting opinion. Dissenting opinions have no force in the law. The legal literature finds that they are sometimes strategically used by Justices who write "spirited dissents" with the objective of providing arguments for potential future reversal of a decision of which they do not approve (Banks, 1999).

Sometimes, Justices who have voted on the same side of a case write separate opinions when the arguments supporting their decision are different. "Plurality opinions" are written when more than half the Justices agree on the judgement but not on the rational supporting the judgement (Spriggs and Stras, 2011). In such situation, concurring opinion(s) are also made available. An example of plurality decision was the Alice Corporation Pty. Ltd. v. CLS Bank International, et al. (573 U.S. 208) in 2014. Five Justices wrote the majority opinion (also called lead opinion), and four Justices wrote a separate concurring opinion in which they partly concurred with the rationale in the majority opinion and presented aspects on which they disagreed.

By the principle of majoritarism followed by the Supreme Court, only the majority decision and its opinion are binding for lower courts. Plurality decisions can sometimes result in a decision with no majority opinion. In such situations, the decision has no binding precedential effect and is applicable only to the parties in the focal case (Kimura, 1992). None of the patent cases over the period 2000-2015 present such an outcome.

2.4 The Supreme Court in the Literature

Legal scholars and political scientists have long debated which internal and external factors influence decisions in courts (Baum, 1977; Epstein et al., 1989; Gely and Spiller, 1989; McCubbins et al., 2005, 1994b; Spiller and Gely, 1992; Spiller and Tiller, 1997). From a policymaking point of view, the agenda-setting phase (the *certiorari* phase) and the policymaking phase (the *merits* phase) can be distinguished clearly in the Supreme Court. This section presents the constraints, incentives, and limitations the Supreme Court Justices face in each phase of the policy process.

2.4.1 Constraints

Parties can petition the Supreme Court only after going through lower courts. As a result, the sample of cases that reach the agenda-setting phase are likely to be biased towards cases with parties that have the incentives and the resources to make a petition. In this phase, case selection is legally constrained by Article III of the US Constitution. This article limits the Supreme Court's power to set their agenda based on jurisdiction and stipulates the need for cases to be the subject of an actual controversy, to be ripe, and to involve litigants that have standing. In theory, the implementation of case selection is based on Rule 10 (Supreme Court of the United States, 2017). Ulmer (1984) attempts to determine how conflicts predict grants of *certiorari*, while qualitatively assessing and excluding cases "in which a conflict is claimed but in which examination indicate no genuine inconsistency in outcomes or doctrine" (Feeney, 1975). Ulmer (1984) compares the predictive power of several variables referred to as an important "cue" for *certiorari* decisions (Songer, 1979), and finds conflict to be the most significant predictor of a grant. Concretely, a common case of conflict considered by the Supreme Court is a circuit split. In the case of patent cases, there is only one court: the CAFC. Therefore, circuit splits are not possible. However, another potentially relevant situation of conflict is the intra-circuit split in which the CAFC panel of three judges is not unanimous. The most prominent example in recent patent cases is the Alice Corporation Pty. Ltd. v. CLS Bank International, et al., 768 F. Supp. 2d 221 (D.D.C. 2011) decision. Lastly, conflict may also be indicated by a disagreement between the ruling of the District court and the ruling of the CAFC. Based on Rule 10, the Supreme Court seeks information to tease out "important and far-reaching" cases (Black and Boyd, 2012). In practice, the cases accepted by the Supreme Court are generally of two types. In the first type, the dispute is about an element of the US Constitution. The second type of

case is those in which the law does not provide a clear answer and the case is perceived by a majority of the Justices as having important socio-economic impact (Murphy, 1964). The Court has no obligation to provide an explanation for its decisions at this phase. In sum, Rule 10 provides two main criteria in a language that leaves the Justices significant discretion to decide.

The Justices also have discretion to interpret the Constitution and laws made by other branches of government in making their ruling in the *merits* phase. There are no official rules (Supreme Court of the United States, 2017) dictating how the final ruling should be made and what kind of arguments can justify a decision. Rule 10 implicitly provides some guidance by considering that a key goal is to seek a coherent body of law. Another aspect to note is that rules of the Supreme Court (Supreme Court of the United States, 2017) do not give any instructions related to advancing the policy preferences of the Justices (Baum, 1993).

As pointed out by Baumgartner and Jones (2015, p. 37), ambiguity in the Constitution is a desirable feature rather than a problem; this can be illustrated by the commencement address given by Justice David Souter to the class of 2010 at Harvard University. Justice Souter uses the example of the case of the Pentagon papers, in which the values of freedom of press are in tension with national security concerns, to illustrate the following point:

> *"A choice may have to be made, not because language is vague but because the Constitution embodies the desire of the American people, like most people to have things both ways. […] These paired desires of ours can clash, and when they do a court is forced to choose between them, between one constitutional good and another one."*

Laws adopted in the executive and legislative branches of government also reflect goals that are supported by at least part of the citizens, and these goals are very often in tension

with the desires of other citizens. The Supreme Court has the power to make policy by interpreting these laws in the judicial review process without rewriting them.

Because of this apparent lack of constraint and accountability, legal studies have identified the Justices as seekers of legal policy, starting with the work of Murphy (1964). Within an institutional setting of existing laws and past decisions (precedents), Justices make legal policy decisions by establishing jurisprudence. However, despite having the power to strike down laws and reverse precedents in the *merits* phase, the Justices refrain from taking such actions lightly because of the constraints and incentives presented in section 2.4.1 and section 2.4.2 (among others: Baum, 1977; Black and Owens, 2009b; Caldeira et al., 1999; Epstein and Knight, 1998; Murphy, 1964).

Appointed Justices are often eminent lawyers who have been trained to reason within the existing laws and precedents (Baum, 1977): "all lawyers [and future justices] undergo law-school training that emphasizes the value of legally oriented judging."

In addition, the Supreme Court does not have enforcing power, and its main powers rest in the legitimacy of the institution (Murphy, 1964). Given the dependence of the Supreme Court's power on legitimacy in dealing with the other branches of government, any departure from the status quo has to be carefully justified (Baum, 1977; Epstein et al., 1989; Gely and Spiller, 1989; McCubbins et al., 2005, 1994b; Spiller and Gely, 1992; Spiller and Tiller, 1997). The elected branches of government are likely to be influenced by public perception of the legitimacy of the Supreme Court decisions they are enforcing. A long-standing debate in the literature has been about the independence of the courts. Part of the literature points to characteristics of the system, such as the Justices' appointment and tenure, that free the judges from political pressure, (Posner and Landes, 1975) while others view the courts, particularly the Supreme Court,

as a policymaking organ (Dahl, 1957). In this view, Justices behave as sophisticated, strategic actors (Caldeira et al., 1999; Epstein and Knight, 1998). Their choices are interdependent with aspects beyond their political preferences such as the preferences of fellow Justices, the executive and legislative branches of government, and the public (Epstein and Knight, 1998). Interactions between Justices at the *certiorari* phase, imposed by the Rule of Four applied to grant *certiorari*, have been documented by Epstein and Knight (1998), with behaviors such as defensively denying *certiorari* by anticipating unwanted outcomes in the *merits* phase or strategically leveraging the threat of dissenting in the merits phase. In sum, the legal literature points out that Justices have policy goals. However, in achieving these goals, legal considerations are far from being irrelevant in the Justices' decision-making, and are instead rather central. Black and Owens (2009, p. 1062) find empirical evidence, using a sample of nondeath penalty petitions, that "at the intersection of law and politics, law is both a constraint on and an opportunity for Justices."

2.4.2 Incentives

Within this environment of legal constraints and opportunities and while the judicial branch is theoretically apolitical, legal scholars consistently point out that a key driver of the Justices' decisions are their policy preferences (Dahl, 1957; Martin and Quinn, 2007; Segal and Spaeth, 2002). Given that Justices are appointed by a president with undeniable policy preferences, Dahl (1957) points out that "under any reasonable assumptions about the nature of the political process, it would appear to be somewhat naive to assume that the Supreme Court either would or could play the role of Galahad."

As Justice Frankfurter points out, many of the great justices who have left their mark had little to no prior judicial experience and were not anonymous and invisible enforcers of the law (Dahl, 1957; Frankfurter, 2006). Justice Frankfurter also highlights

the fact that the Supreme Court could not be influential in American politics if Justices were selected on their judicial qualities with no consideration for their policy preferences (Dahl, 1957).

Justices have the incentive to push an agenda of legal policy (Epstein and Knight, 1998; Martin and Quinn, 2002; Murphy, 1964; Segal and Spaeth, 2002) consistent with their preferences (Dahl, 1957; Martin and Quinn, 2007; Segal and Spaeth, 2002). In order to succeed, they need to consider both the desirability of the status quo (Bonneau et al., 2007; Hammond et al., 2005) and their preferences.

Studies have found that the Justices' voting behavior in the *merits* phase reflects their preferences (Martin and Quinn, 2007; Segal and Spaeth, 2002). For the agenda-setting phase, there is no consensus among initial studies on the role of Justices' legal and policy preferences (among others: Brenner and Krol, 1989; Caldeira and Wright, 1988; Palmer, 1982). Later work introduces more nuance by examining ideological proximity between the Justices' preferences and two outcomes: the predicted outcome on the *merits* phase (Caldeira et al., 1999) and the status quo (Bonneau et al., 2007; Hammond et al., 2005). Justices are individuals capable of making backward induction reasoning to elaborate strategies to shape legal policy (Epstein and Knight, 1998; Martin and Quinn, 2002; Segal and Spaeth, 2002). Black and Owens (2009, p. 1064) build on these findings to propose a model that takes into account the fact that "[Justices] should pay attention not just to where the Court will set policy, but how that policy will change the benefits they currently enjoy." As a result, the likelihood of Justices granting *certiorari* depends on the relative proximity of their ideology with the expected outcomes on the *merits* phase and the status quo. If they are ideologically closer to the expected final decision, they are more likely to grant *certiorari*, while if they are ideologically closer to the status quo, they are more likely to deny it.

Given the importance of legitimacy for the Supreme Court, Justices seek to provide valid arguments to support their position and the final ruling of the Court as they advance their individual policy preferences. In addition, given the complexity of some decisions, litigants and amici are important actors that provide information to the Court (Spriggs and Wahlbeck, 1997). As a result, to be discussed in further detail in Chapter 4, scholars have examined the influence of stakeholders through their presence (Chien, 2010), their status (Black and Boyd, 2012), and the information they bring to the court (Spriggs and Wahlbeck, 1997). Studies using plagiarism software have found evidence that the language of Supreme Court opinions are influenced by both parties' briefs (Corley, 2011) and amicus briefs (Collins et al., 2015; Spriggs and Wahlbeck, 1997). In addition to the content of the briefs, the literature has also found that participation itself influences the final ruling (Chien, 2010; Songer and Kuersten, 1995).

Regardless of policy preferences, the following incentives can also drive the Justices' behavior. First, Justices are likely to aspire to certainty and consistency in the law, as prescribed in Rule 10. The Supreme Court may grant *certiorari* because the Justices want to reverse a lower court's decision when they assess that the decision is not in conformity with the legal doctrine (Kornhauser, 1992). This may occur when a lower court treats a case based on a set of rules that differs from the set of rules that the Supreme Court deems appropriate for the given case and for all cases of equivalent class. The Justices will have an incentive to accept the case on their policy agenda in order to rectify the discrepancy and ensure consistency in the law in their view.

Second, Justices can decide to accept a case on their agenda in order to implement a longer-term strategy to have lower courts comply with this equivalence of classes. To force lower courts to comply, the Supreme Court has few motivational tools compared to common hierarchical superiors (who can promote, fire, change salaries,

etc.) (Cameron et al., 2000). The main leverage that can be used by the Supreme Court is related to status in judicial culture (Cameron et al., 2000). Lower court judges have incentives to avoid reversal by higher courts because "[f]requent reversals bring the derision of colleagues and a decline in professional status" (Perry, 1991).

Lastly, Justices can accept to review cases even if they agree with the lower court's decision. Justices occasionally perform "aggressive grants" and affirm a lower court's decision in order to make it applicable at a national level (Cameron et al., 2000). These are clearer cases in which Justices seize opportunities to go beyond enforcement and actively create policies. Formal modelling of the Supreme Court behavior and empirical evidence have focused on the enforcement actions or failed to distinguish it from the creation actions of the Court (Cameron et al., 2000).

2.4.3 Limitations

In addition to constraints (mainly based on Article III of the US Constitution) and individual incentives, Justices have limitations that prevent them from making the most optimal decisions. Policymakers are boundedly rational human beings (Simon, 1972), and Supreme Court Justices are no exception. Policy problems are often complex (or "wicked") (Rittel and Webber, 1973) and not well defined (Simon, 1973).

A full picture of the existing problems is needed for policymakers to decide where to allocate their attention and set an agenda (Baumgartner and Jones, 2015; Jones and Baumgartner, 2005). Nowadays, the Supreme Court typically receives 7,000-8,000 petitions each term[13] and each Justice is allowed four to five clerks per term. Even assuming that the nine Justices, each with four clerks, are able to work in parallel and split the cases (which is not possible, since several Justices need to agree to take a case), the caseload per person is over 150 petitions per term. The case overload of Supreme

[13] Source: www.supremecourt.gov

Court Justices was already considered problematic when the number of petitions reached 4,000 in the 1970s (Griswold, 1974). Since humans have limited cognitive abilities to correctly process large amounts of information, there is a risk of the adverse effects of crowding out in the decision-making process. In addition, while the level of technicality of cases varies, many cases require technical knowledge that the Justices do not have. For example, some patent-related cases require an advanced understanding of technology and of the economic strategy underlying patenting behavior. As a result, making informed decisions often requires making an extensive effort of collecting and processing information under resources constraints. Anecdotal evidence that illustrates Justices' lack of willingness to seek out expert knowledge related to patents is the fact that Supreme Court clerks are hired with prior experience in almost all federal court circuits, but only one clerk with CAFC experience has ever been hired (Dyk, 2016).

Policymakers are part of governmental organizations, and the structure of these organizations also affects information processing (Simon, 1991). While organizations have larger capacities and resources to collect and analyze information than individuals, they still face tradeoffs between a costly but more exhaustive broad search and focusing early on key information to reduce costs at the expense of potentially missing important information (Knudsen and Levinthal, 2007).

Both individuals and organizations filter information through multiple biases when evaluating alternatives to make a policy decisions: bias against risky alternatives (Denrell and March, 2001), inconsistent and changing preferences (Tsetsos et al., 2012), biased perception of the problem itself, as well as evaluation of the alternatives (Tversky and Kahneman, 1981). Jones et al. (2003) point out that such frictions in information processing lead to long periods of stability in policymaking interrupted by

major punctuations of policy change due to new information, new actors, or important preference changes.

2.5 Empirical Setting for Studying the Role of Stakeholders and Information

This dissertation uses the setting of patent policy made in the Supreme Court as a setting to support theoretical contributions with empirical evidence in Chapter 3 and Chapter 4. In the Supreme Court, the agenda setting phase and the policymaking phase are distinct and interactions between the policymakers and stakeholders are recorded in court documents. In addition, as discussed in further detail in section 2.5.3, focusing on patent policy also provides several advantages for an empirical strategy because 1) patent-related issues are relatively non-partisan and cases are decided either unanimously or not along party lines and 2) there is high information asymmetry in knowledge on technology and patenting behavior. As a result, decisions are not predicted by partisanship and the role of stakeholders and information, particularly expertise, may play a role in influencing decisions, as stated in the Cochrane v. Deener, 94 U.S. 780 (1877) opinion of the Court:

> *"It would, perhaps, be desirable if all cases of this sort [i.e., patent cases] could be referred to a commission of intelligent experts and practical men to report their opinion thereon, with their reasons, for the final action of the court. ... Neither courts nor ordinary juries are perfectly adapted to the investigation of mechanical and scientific questions."*

The following section provides key facts about patent policymaking and describes the information contained in court documents.

2.5.1 Description of patent policymaking

Patents are used by policymakers to trade off deadweight loss due to a temporary exclusive right with economic growth resulting from a higher rate of innovation (Schumpeter, 1942). The key challenge is to identify the level of patent strength that

enhances incentives to innovate and optimizes social welfare (Bessen and Raskind, 1991).

All three branches of the United States government are involved in patent policymaking. The executive branch acts mainly through the White House, the Department of Justice, and the United States Patent and Trademark Office (USPTO). Other agencies that tackle issues related to patents occasionally get involved, such as the National Institute of Health (NIH) or the Federal Trade Commission (FTC). The legislative branch is represented by Congress, while the judicial branch involves the District Courts of the Federal circuit, the CAFC, and the Supreme Court.

Concretely, since the 1990s, courts have been the primary policymakers in intellectual property (Chien, 2010) and the Supreme Court has been actively involved since about the year 2000 (Holbrook, 2013). Regarding patent policy, there are two obvious ways in which courts interact with the other branches of government. First, the Supreme Court occasionally redistributes power to the executive branch by requiring input generally from the Solicitor General and the USPTO for cases filed at the CAFC (Rai, 2012). Second, Congress has the ability to make structural adjustments that alter the jurisdiction of the courts (Spiller and Tiller, 1997). Also, although it is rarely used, Congress also has the power to overrule a court decision, such as in Roche Products v.

Bolar Pharmaceuticals[14] and Deepsouth Packing Co., Inc. v. Laitram Corp[15] (Holbrook, 2007).

Chien (2010) finds descriptive evidence that participation from the executive branch has an effect on decisions through amicus briefs. Between 1989 and 2019, the courts sided with the government in 90% of patent cases at the Supreme Court and 80% of patent cases in the Federal Circuit for which amicus briefs were filed on the merits, in the position-taking phase, by the Solicitor General and sometimes with the USPTO and other entities related to executive power (Chien, 2010). In comparison, in the merits phase of the 31 patent-related cases decided at the Supreme Court over the period 2000-2015, the Supreme Court ruled 21 times (81%) in favor of the side supported by an entity related to the executive branch of government out of the 26 instances in which such an entity was a participant. With regard to the legislative branch, the literature provides anecdotal cases of the effect of the influence of Congress on court decisions in patent policy (Holbrook, 2007) but does not include empirical tests of the systematic existence of this relationship.

[14] Roche Products v. Bolar Pharmaceuticals, 733 F.2d 858, 221 USPQ 937 (Fed. Cir. 1984). The Supreme Court rejected the "experimental use" justification for the use of a patented chemical before patent expiration when the experimentation had a business purpose. In the focal case, a generic drug manufacturer experimented on patent knowledge to obtain FDA approval before the patent expired so that they would be able to compete on the market when the patent expired. The Supreme Court considered this behavior as patent infringement. Congress then passed the Hatch-Waxman Act, modifying section 271-e-1 to permit such use of patented knowledge in experiments aimed at obtaining FDA approval.

[15] Deepsouth Packing Co., Inc. v. Laitram Corp. 406 U.S. 518 (1972). The Supreme Court ruled in favor of an accused infringer who had manufactured the components of a patented device but had exported and assembled the parts outside of the United States. Congress overruled this decision to adopt §271(f) to consider such behavior as patent infringement. Additionally, Congress adopted §271(f)(2) to expand the consideration of infringement as the "exportation of a component of a patented device with no substantial non-infringing use." (Holbrook, 2007)

Burk and Lemley (2009) and Chien (2010) argue that the courts have used the flexibility of interpretation allowed by patent law to tailor decisions to different industries, aided by information provided by stakeholders in amicus briefs. However, these studies do not support these claims with empirical analyses that allow us to assess the extent to which patent policies, as enacted by the courts, favor one or another segment of firms.

As the number of legal disputes concerning patents continuously increases, precedents set with decisions on these disputes occasionally change aspects of the strength of patents: the scope of patenting, the breadth of interpretation of the claims, and the ability to exclude infringers from using patented knowledge (Walsh et al., 2016) and other administrative aspects. There is no clear correct answer based on the law in many patent cases for the following reasons. First, boundaries in knowledge are fuzzier than property rights over tangible goods. Second, by definition, innovations come in various unpredictable forms to which the existing rules are not adapted. Lastly, the complexity in estimating the consequences of a decision increases because the types of entities involved in these disputes vary widely depending on the technology field, organizational structure, availability of resources, and business models. As a result, courts do not simply solve disputes between parties; they are often compelled to consider socio-economic and ethical implications. As a result, patent-related Supreme Court cases are likely to involve more knowledge asymmetry than the average Supreme Court case and Justices are therefore likely to rely on information in the stakeholders' briefs.

Because the ultimate goal of the patent system is to maximize public welfare, the groups that are affected by the system need to be considered. Chien (2010) and Caldeira and Wright (1988) point out that amicus briefs give the courts information

beyond the content of the briefs regarding the nature, the number, and the diversity of stakeholders in the case. Policymakers are likely to perceive a problem as having an important socio-economic impact on many entities if a large number of advocates mobilize. In patent cases, the presence of amicus briefs at the appellate level increases the probability that the Supreme Court will accept the case (Chien, 2010). As an extension of this reasoning, an increase in advocates for a position could be predicted to increase the perceived legitimacy of the arguments supporting that position. Caldeira and Wright (1990) find that for all types of cases at the Supreme Court, public interest law firms and citizen groups participate more at the *merits* phase than at the petition phase. In addition, they find that despite opportunities to save costs, amici seem to prefer to file separate briefs rather than cooperating. Therefore, interest groups seem to consider that there is value in the number of briefs filed on a position. Nevertheless, Chien (2010) finds that, for patent cases, the number of amici supporting a particular side has a significant positive effect on the side ultimately winning. In addition, she finds that consumer groups are underrepresented, which can be explained by their lack of organizational and knowledge resources compared to those of for-profit corporations. Although the financial threshold and acceptance conditions are low given the low cost of filing an amicus brief (less than USD20,000, according to Chien (2010) and Caldeira and Wright (1988)) and the high rate of acceptance by courts, the briefs do not proportionally represent affected groups. The rejection of an amicus brief is a very rare event: 91 out of the 832 requests (called “motions for leave to file amicus brief”) were rejected over the period from 1969 to 1981 (Caldeira and Wright, 1990). In addition, certain types of interest groups might have more weight on the decision. Lohmann (1993) points out that private firms are more likely to have the resources to engage in

mass political action and create a negative public perception of a governmental entity by complaining.

In terms of the content of such briefs, Chien (2010) finds that on patent-related issues, amicus briefs are more likely to influence the Supreme Court by using new arguments rather than repeating legal arguments already mentioned by the parties. This is partly consistent with the findings of Black and Boyd (2012). Using four terms of Supreme Court nondeath penalty cases, Black and Boyd (2012) found that new arguments brought by amici influenced the agenda setting phase when amici reiterate the litigants' arguments, and reinforce the position of the party they support.

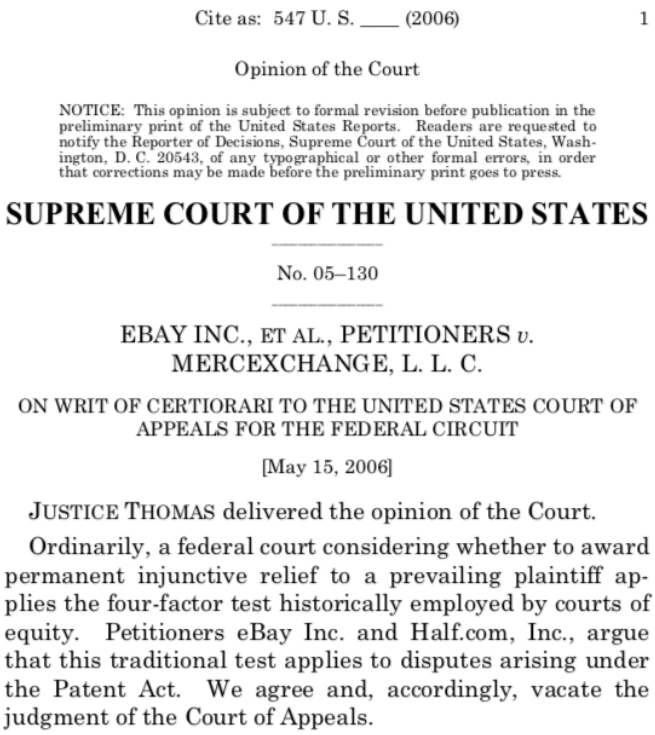
2.5.2 Data: Structure of court documents

Opinions are published in the United States Reports, which are official reports of decisions published by the US government. Opinions are composed of the majority opinion followed by concurring or dissenting opinions if there are any. The opinions are preceded by a syllabus summarizing key facts of the case up to the Supreme Court's decision.

The opinion section includes a header that provides the following information about the case (Figure 1). The header indicates the Supreme Court docket number, which is followed by the name of cases that contain information about the litigants: the name of the petitioner(s) followed by the term "petitioners." Then, the name of the respondents is listed with the two sides separated by a "v." indicating that the petitioner(s) and the respondent(s) are arguing against each other. Third, the date the ruling was decided by the Court is recorded.

The main body of the opinion is composed of several parts. It starts with the name of the Justice delivering the majority opinion, followed by a short definition of the issue at stake. That paragraph is followed by the main arguments supporting the

majority opinion's ruling. Although the structure is not systematic, it is very common for the argumentation to be divided into two sections with a first section summarizing the case up to the grant of *certiorari*, and a second section justifying the decision itself.



Cite as: 547 U. S. ____ (2006) 1

Opinion of the Court

NOTICE: This opinion is subject to formal revision before publication in the preliminary print of the United States Reports. Readers are requested to notify the Reporter of Decisions, Supreme Court of the United States, Washington, D. C. 20543, of any typographical or other formal errors, in order that corrections may be made before the preliminary print goes to press.

SUPREME COURT OF THE UNITED STATES

No. 05–130

EBAY INC., ET AL., PETITIONERS *v.*
MERCEXCHANGE, L. L. C.

ON WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

[May 15, 2006]

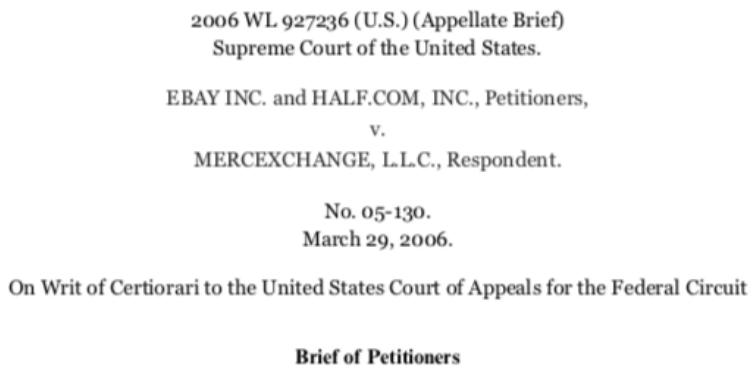
JUSTICE THOMAS delivered the opinion of the Court.

Ordinarily, a federal court considering whether to award permanent injunctive relief to a prevailing plaintiff applies the four-factor test historically employed by courts of equity. Petitioners eBay Inc. and Half.com, Inc., argue that this traditional test applies to disputes arising under the Patent Act. We agree and, accordingly, vacate the judgment of the Court of Appeals.

Figure 1 Example of an opinion header

The content and the order of the parties' briefs are defined by Rule 14 and Rule 15 for the petition phase and Rule 24 for the *merits* phase (Supreme Court of the United States, 2017), while Rule 37 gives instructions for amicus curiae briefs. All briefs first include (Figure 2 and Figure 3) a concise statement of the question at issue, a list of all participants involved in the brief along with information about the side they support (as party or amici), and the date of the brief. A table of contents follows alongside a list of citations. The list of citations includes a table of cited authorities (compulsory if the

petition exceeds 1,500 words), citations of the "official and unofficial reports of the opinions and orders entered by the courts or administrative agencies," as well as references to "the constitutional provisions, treaties, statutes, ordinances, and regulations involved in the case." Third, an argumentation supporting a review of the case by the Supreme Court is presented. The rules put an emphasis on conciseness and warn that a brief that does not comply with all the rules may be denied. In the argumentation section, a paragraph presenting a condensed "summary of the argument" precedes the "argument" section.



2006 WL 927236 (U.S.) (Appellate Brief)
Supreme Court of the United States.

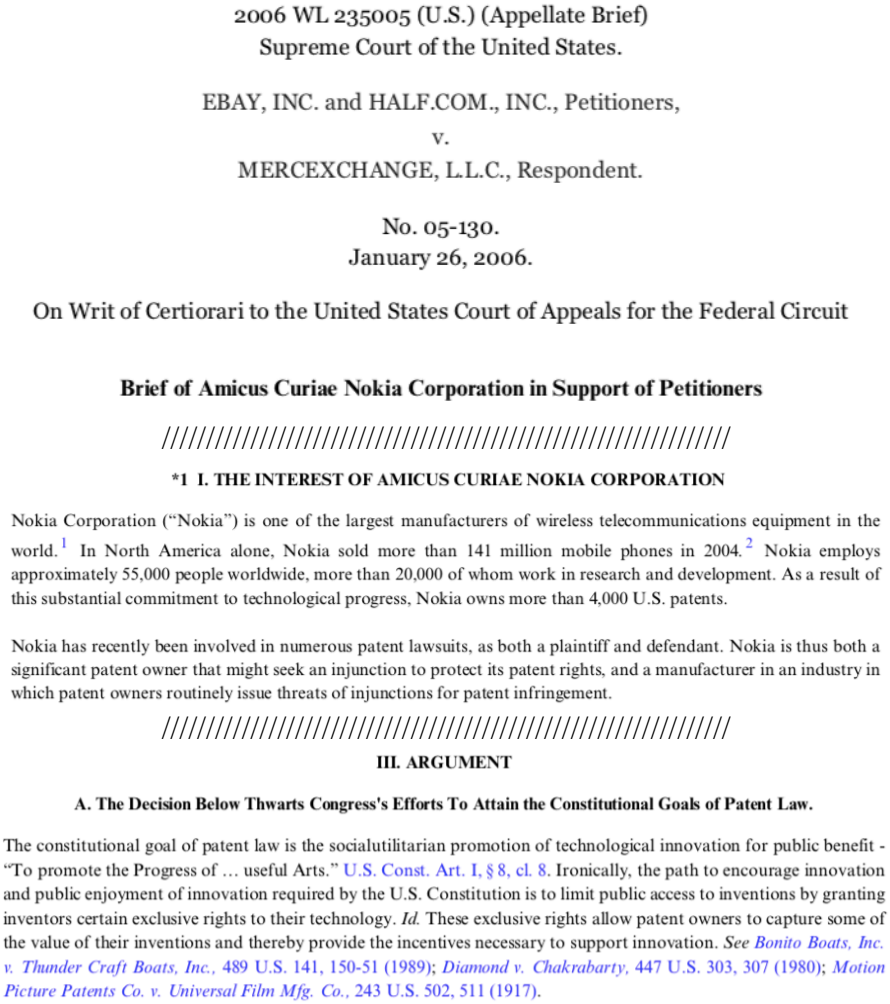
EBAY INC. and HALF.COM, INC., Petitioners,
v.
MERCEXCHANGE, L.L.C., Respondent.

No. 05-130.
March 29, 2006.

On Writ of Certiorari to the United States Court of Appeals for the Federal Circuit

Brief of Petitioners

Figure 2 Example of a party brief's header



2006 WL 235005 (U.S.) (Appellate Brief)
Supreme Court of the United States.

EBAY, INC. and HALF.COM., INC., Petitioners,
v.
MERCEXCHANGE, L.L.C., Respondent.

No. 05-130.
January 26, 2006.

On Writ of Certiorari to the United States Court of Appeals for the Federal Circuit

Brief of Amicus Curiae Nokia Corporation in Support of Petitioners

//

***1 I. THE INTEREST OF AMICUS CURIAE NOKIA CORPORATION**

Nokia Corporation ("Nokia") is one of the largest manufacturers of wireless telecommunications equipment in the world.[1] In North America alone, Nokia sold more than 141 million mobile phones in 2004.[2] Nokia employs approximately 55,000 people worldwide, more than 20,000 of whom work in research and development. As a result of this substantial commitment to technological progress, Nokia owns more than 4,000 U.S. patents.

Nokia has recently been involved in numerous patent lawsuits, as both a plaintiff and defendant. Nokia is thus both a significant patent owner that might seek an injunction to protect its patent rights, and a manufacturer in an industry in which patent owners routinely issue threats of injunctions for patent infringement.

//

III. ARGUMENT

A. The Decision Below Thwarts Congress's Efforts To Attain the Constitutional Goals of Patent Law.

The constitutional goal of patent law is the socialutilitarian promotion of technological innovation for public benefit - "To promote the Progress of … useful Arts." U.S. Const. Art. I, § 8, cl. 8. Ironically, the path to encourage innovation and public enjoyment of innovation required by the U.S. Constitution is to limit public access to inventions by granting inventors certain exclusive rights to their technology. *Id.* These exclusive rights allow patent owners to capture some of the value of their inventions and thereby provide the incentives necessary to support innovation. *See Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 150-51 (1989); *Diamond v. Chakrabarty*, 447 U.S. 303, 307 (1980); *Motion Picture Patents Co. v. Universal Film Mfg. Co.*, 243 U.S. 502, 511 (1917).

Figure 3 Example of an amicus brief's header

Citations of legal precedents and external documents are used in this study. References to Supreme Court decisions follow a relatively standardized format. For example, eBay v. MercExchange is cited as 547 U.S. 388 (2006). This means that the case was decided in 2006 and that the opinion appears on page 388 of volume 547 of the United States Reports. Decisions may be published with a lag of several years.[16] Therefore, citations sometimes refer to the unofficial Supreme Court Reporter that is published more frequently than the United States Reports. For the same eBay v. MercExchange decision,

[16] http://guides.ll.georgetown.edu/c.php?g=261289&p=2339383

the citation in the Supreme Court Reporter is 126 S. Ct. 1837. In the empirical sections of this dissertation, I use a table of correspondence between the two formats of citations, built manually using information on Westlaw, to convert all citations in Supreme Court Reporter format to the United States Reports format in order to identify unique decisions.

References to decisions in the United States Courts of Appeals also follow a standardized format. Precedential decisions are published in the Federal Reporter. For example, the citation of the CAFC case opposing eBay and MercExchange is 401 F.3d 1323. "F.3d" indicates that the decision was published in 1993 or later in the Federal Reporter, Third series. Decisions published in the first series ranging from 1880 to 1924 are cited with an "F.," and the second series ranging from 1924 to 1993 are cited with "F.2d." While some decisions that are not considered as precedents are sometimes cited by academics, they are not published in the Federal Reporter and will be excluded from the empirical analyses in this thesis.

Decisions in the US District Court are published in the Federal Supplement and are marked with variations of "F. Supp"; "F. Supp" refers to the first series ranging from 1933 to 1998, while the second and third series are referenced with "F.Supp.2d" for 1998-2014 and "F.Supp.3d" for decisions published from 2014.

In the empirical parts of this dissertation, legal precedent citations are scraped directly in the body of the argumentation for opinions as well as in party and amicus briefs.

Contrary to legal citations, references to other sources such as academic articles present more variation in format. In opinions, I manually identify citations. For party and amicus briefs, I rely on the table of authorities listing all the references made in the

body of the argumentation. I use the format of the table of authorities, in which each reference listed starts on a new line, to scrape the documents and build a data set of non-legal references made in briefs. I manually identify all references made to academic articles as a proxy for expert information. I also identify publications made by non-profit organizations that do not represent the interest of private companies as expert information. In addition, I create a table of correspondence between the original citation format and a cleaned citation version to identify identical citations. This allows the creation of a list of unique citations by brief, solving the issue of variation from brief to brief in the format of citation for a given publication.

2.5.3 Empirical strategy

To empirically examine the role of different types of information and stakeholders in the policy process in the judicial branch of government, I use the setting of patent policymaking in the Supreme Court over the period 2000-2015. Key features of this setting are the following.

First, patent-related issues are relatively non-partisan. The Supreme Court decisions have been unanimous in two-thirds of the cases decided over the period 2000-2015 and among the remaining third, none of the dissents follow party lines. Sag et al. (2009) find that there is an effect of ideology on Supreme Court decisions in IP cases for conservatives only. However, the effect is significantly weaker compared to other cases. In addition, this effect varies across types of IP and the effect is significantly smaller for patents compared to copyrights. Therefore, while IP is not a strictly apolitical topic, IP is different from other cases, "if not entirely exceptional" (Sag et al., 2009). The outcomes are not strongly predicted by partisanship and there is room for argumentation to influence the policymakers.

Second, patent disputes are characterized by a high information asymmetry between stakeholders and policymakers. Many of the cases require an understanding of technology and the economic strategy driving patenting behavior. The pace of technological change continuously increases and strategic decisions involving patents are not always observable. As a result, closing the gap would require continuously updating the policymaker's knowledge, incurring high costs for collecting up-to-date information, even for a Justice with advanced technical training. Stakeholders that conduct the research and development producing the technologies that are involved in the cases, users of patents in innovation strategies, and patent law scholars and practitioners, have the knowledge that Justices need to make better decisions. Because of this information asymmetry, Justices have incentives to use the knowledge provided by stakeholders. This provides stakeholders with power to influence policymakers (Cyert and March, 1963; March, 1987, 1962).

In the setting of patent policy, the courts are the primary policymakers and the Supreme Court has been central since 2000 (Chien, 2010; Holbrook, 2013). An advantage of this setting over lobbying in the elected branches of government is that the exchange of information between stakeholders and policymakers (Supreme Court Justices) is observable. In addition, the argumentation supporting the policymakers' decisions is also published in an *opinion* and is therefore observable. Both stakeholders and policymakers support their argument by citing legal precedents and various external documents (academic articles, industry reports, newspaper articles, etc.) referenced in a relatively standardized format. The amount of information provided by stakeholders shows a high level of variation contrary to the amount provided by lobbying in other branches of the government.

Stakeholders lobbying in the elected branches of government frequently lobby for multiple issues, or issues with multiple aspects. This is a major challenge in identifying any causal relationship between lobbying and the information provided with the adoption of a law. In the Supreme Court setting, however, the outcome "success" is clearly defined by whether the firm is on the winning or losing side of a case. In addition, policy change is associated with three aspects of patent strength (Walsh et al., 2016). The first dimension is patentability, while the second is the breadth of interpretation of the boundaries of claims. The third dimension is the ability to exclude others from using the patented technology. I consider these aspects to be three policy topics with a multi-dimensional metric corresponding to an increase or a decrease in strength on each dimension. Each decision made by the Supreme Court affects one or more of these aspects, and the interactions between stakeholders and policymakers can be associated with the results. In a recent seminar,[17] Director of the USPTO Andrei Iancu suggested that distinguishing these different topics might be important. In response to a question asked by inventor and entrepreneur Lonnie Johnson[18] regarding the influence of amicus briefs submitted by the USPTO in Supreme Court decisions, the Director responded that the USPTO seems to have an influence sometimes but that it "hasn't been so successful when it comes to section 101 (patentable subject matters)."

Policy changes measured as Supreme Court decisions create a one-dimensional change within the policy topics. Aspects are strengthened or weakened. While the size of the change is difficult to evaluate, the direction of the change is clear. Therefore, it

[17] "A Discussion with Andrei Iancu, Undersecretary of Commerce for Intellectual Property and Director of the United States Patent and Trademark Office" at the Scheller College of Business at Georgia Tech, February 25th 2019

[18] Inventor the Super Soaker water gun, which has been among the world's bestselling toys every year since 1991 (https://www.biography.com/people/lonnie-g-johnson-17112946)

is possible to control if there have been shifts in positions by both the firms and the Court.

All amici are entities that have chosen to act rather than "free ride" despite the collective action problem that exists. Given that jurisprudence is applicable to all, there are no individual benefits that can be obtained by performing this action. The decisions that stakeholders make are: choosing which position to support, choosing which arguments to make to support the chosen position, undertaking an individual or collective non-market action, and in case of a collective non-market action, deciding what form it will take – as part of a trade association and/or filing an amicus brief with other entities, engaging in a "relational" strategy with repeated interactions over time or a "transactional" one-off action (Hillman and Hitt, 1999). The results of this study allow inferences to be made purely based on the efficiency of the strategy chosen and the firms' knowledge. Transaction costs are limited to coordinating interactions with other entities to write the brief in collaboration and possibly sharing the cost of legal counsel, which is estimated to be lower than USD20,000 (Caldeira and Wright, 1988; Chien, 2010). This relatively low cost to some extent mitigates the concern of selection bias towards high-resource participants compared to lobbying, for example. However, there is still some concern that the entities that have more capacity to monitor cases that provide opportunities for policy change will be over-represented. In addition, a limitation of the use of amicus briefs as an indicator of the amici's interest in the case is that parties sometimes ask other entities to support their position with an amicus brief. Therefore, the analysis may be underestimating the importance of the role of parties on the outcome of cases.

Lastly, stakeholders can only participate with briefs as parties or amici, and cannot provide benefits, such as financial donations for example, to the Supreme Court

Justices. In addition, Supreme Court Justices are appointed for life. Therefore, I can argue that in the Supreme Court, concerns for financial incentives or constituency-building are as negligible as they can possibly be for policymakers. This feature mitigates the concerns for unobserved influences that stakeholders can exert on the policymaker.

These features solve for the three key traditional challenges faced by studies in isolating causal mechanisms between the behavior of stakeholders in the policy process and policy outcomes (de Figueiredo and Richter, 2014; Pittman, 1977; Zardkoohi, 1985).

There are limitations in using this setting. The Supreme Court receives about 7,000-8,000 petitions per term.[19] Less than a hundred of those cases were accepted each term over the period 2000-2015 (see Table 1), and among accepted cases, less than 2% were patent-related.

In addition to representing a small share of the cases, the specificity of not being partisan makes patent cases different from a large proportion of the cases in which the question at stake involves a bigger role for partisan preference (Sag et al., 2009). Some topics, such as abortion or civil rights, may allow little external influence and the main predictor of decisions is the number of Justices that have strong political preferences on the topic. Thus, the results of this study will not be applicable to the same extent to all other Supreme Court cases. Nevertheless, this study informs us about how the Justices and stakeholders are likely to behave and influence each other within the latitude allowed by topics and the strength of preferences of the Justices on the bench.

[19] Source: https://www.supremecourt.gov/about/justicecaseload.aspx

The results of this study are more clearly generalizable to cases in which the question is apolitical, and in which the Justices are non-experts. The number of existing cases is still small but is growing. I argue that this is likely to be more and more frequent with the increasing pace of technological change. Some examples that already come to mind for which the executive and legislative branches of government have not set a clear legal framework and disputes are arising are artificial intelligence, data privacy, and migration to data currency. While it is possible that technology may become a partisan issue in the future, we are not there yet.

3 CHAPTER 3 THE HETEROGENEOUS EFFECT OF PATENT STRENGTH ON FIRM INNOVATION

3.1 Introduction

Innovation is central in economic growth and policy measures are key tools for incentivizing profit-maximizing agents to innovate (Romer, 2014, 1994). Patent policy is one of these policies. Its objective is to establish an institutional environment that balances the trade-off between enhancing incentives to innovate and deadweight loss from the exclusivity granted. From a firm strategy perspective, innovation is central to firms' competitive advantage and differences in their strategies to appropriate returns from investments in innovative activities are a key determinant of profitability differences across heterogeneous firms (Ceccagnoli, 2009). This study examines how changes in the institutional environment affect relative payoffs from different firm strategies across heterogeneous sets of firms, focusing on innovation strategy.

Concretely, knowledge boundaries are harder to define than the boundaries of material goods, especially in the case of inventions, which constantly appear in different and unpredictable shapes. Furthermore, setting the right balance between incentives for inventors and efficiency gains from diffusion has been a constant challenge in patent policy. Consequently, policies affecting the strength of patents have been modified multiple times over the years. Both in the academic literature and for policymakers, there is an ongoing debate concerning the effects of patents on firms' incentives to invest in R&D and on the strategic use of patents. Studies trying to answer the question "what is the impact of patent strength on firm innovation?" have improved our understanding of firms' diverse patenting strategies. Nevertheless, the size and direction of the effects of patents on innovation are still debated today (Arora et al., 2008; Boldrin and Levine, 2009; Budish et al., 2016; Cohen, 2005; Jaffe, 2000; Penrose, 1951; Sampat and Williams, 2019; Williams, 2017, 2016).

One of the reasons for the high complexity of the debate is that the strength of patents involves multiple aspects. Walsh et al. (2016) group the aspects of patent strength into three dimensions.[20] The first dimension is the range of inventions patents can protect, which includes the subject matter that is patentable as well as the quality level of inventions in terms of novelty, usefulness, and non-obviousness. The second dimension is the breadth of interpretation on the boundaries of claims, which translates into how close a rival's invention can be without infringing on a patented invention. The third dimension is the ability to exclude others from using the patented knowledge, which is determined by the penalty for those who are found guilty of infringing on a valid patent. This study focuses on the third dimension: the term "strength of patents" in this study henceforth refers to the ability to exclude others from using patented knowledge. In other words, "weaker patents" in this study refers to patents functioning in a way that diverges from the definition of a property right. The first contribution of this study consists in providing insights on patents' characteristic of providing exclusivity. For patent owners, there is an essential expectation that as intellectual property rights, patents should function in a way somewhat similar to property rights for the knowledge they seek to protect. In addition, this aspect is also fundamental based on a Schumpeterian view of the economy. Despite being of central importance, there is little empirical evidence to rely on (Aydin, 2015) compared to other aspects such as patent length, patent breadth, or patentable subject matter, which have received more attention (among others: Gallini 1992, Williams 2010). This study goes beyond the empirical finding of Aydin (2015) that reducing this exclusivity aspect results in a decrease in patenting (and licensing) by examining changes in R&D investments and the composition of both patented inventions and R&D investments in order to provide insights on

[20] These dimensions only consider the strength of patents and do not capture other characteristics of the patent system that also potentially influence the propensity to patent such as the cost of patenting, delays in examination, examiners' training, and administrative aspects.

shifts in the rate and direction of innovation. An important finding of this study is based on going beyond the observation that, on average, reducing the exclusivity that patents confer increases the technological impact (measured with forward citations) of inventions patented by large firms in complex product industries. By examining the composition of patenting activities, I find that the increase of the average is driven by a decrease in the propensity to patent inventions with low technological impact. Consistent with other qualitative and quantitative evidence, this change in the composition indicates a reduction in the practice of building defensive patenting portfolios.

A second key difficulty in settling the debate is that changing the strength of patents triggers a myriad of mechanisms in firms' innovation strategy that complicate predictions about the production of innovation both at the firm level and in the economy. At the firm level, a given firm can both be a patent holder and a potential user of knowledge patented by other entities. Therefore, potential combinations of several types of patenting strategies complicates our understanding of the effect of patent strength on firm innovation. As one French firm's IP officer stated:

> *"The game… the practice [of filing for patents] is more and more complex. There is a little bit of everything. […] The company's industrial strategy is to introduce products and services in the market, which have a significant differentiating technological content. […] The goal [of our patenting strategy] is to protect that differentiation, in an offensive way, whenever possible. Is there also a defensive part? Yes, that too." (Interview with the chief IP officer in an international corporation manufacturing auto parts, September 2016)*

As a result, based on existing empirical evidence, no clear prediction can be made on whether a change in excludability will promote or hinder the production of innovation. In the case of a decrease in patent strength, the most obvious change is a decrease in patents' probability of succeeding in protecting inventions. At a firm level, such a change is likely to impact both firms' propensities to protect inventions using patents and the number of patents required to succeed in protecting each invention (Lemley and Shapiro, 2005). As a result, changes in

patent-related costs and in the ability to appropriate investments may modify firms' incentives to invest in the production of those inventions through R&D. At a macro level, given the cumulative nature of innovative activities (Scotchmer, 1991), a decrease in patent strength can increase the amount of spillovers that lead to innovations in the economy by decreasing the number of patents available as a source of information (Ernst, 2003). However, it can also increase spillovers by reducing the protection of the knowledge they hold private (Galasso and Schankerman, 2014). As a result, a change in patent strength yields reactions that are different in terms of incentives to innovate depending on the role of patents in a firm's innovation strategy, which is contingent on firm characteristics and the technology field (Cohen et al., 2000).

Despite having a corpus of literature that has demonstrated the variety of potential effects, mechanisms involved when patent strength is changed are still typically examined in isolation from each other, particularly in empirical work, in order to solve for identification issues. Therefore, a second contribution of this study is to provide unique empirical evidence regarding the relative importance of these mechanisms for different types of firms when patent strength is changed and their net effect on incentives to invest in R&D and patenting propensity. To propose a comprehensive discussion that integrates the various patent-related firm strategies found in the literature on this research question that is half a century old, I reconcile approaches taken by legal, economics, and management scholars.

In the first part of the study, I examine both the arguments that predict that strong patents (in terms of the exclusivity they provide) are associated with more innovation, and arguments supporting the opposite view. An analysis of the arguments made by 151 stakeholders during a major legal case changing this particular aspect of strength complements the theoretical discussion. The event used is the United States Supreme Court decision eBay Inc. v. MercExchange, L.L.C., 547 U.S. 388, 2006, henceforth called "the eBay case." With its

decision on the eBay case, the Supreme Court shifted away from over a century of practice regarding the rulings for injunctions, creating arguably the most important ruling in the patent system in the past decade (Seaman, 2015). By making patent-related permanent injunctions harder to obtain, the Supreme Court significantly weakened patents in terms of their ability to exclude others from using proprietary knowledge. While this change is a focused case, its examination allows an understanding of how the concept of excludability, which is a defining aspect of intellectual property (IP) rights, is related to firm innovation. Furthermore, a second part of this study consists in quantitatively testing the arguments found in the academic literature and made by those stakeholders. I leverage the eBay case as a shock weakening patents to examine whether changes in R&D investments and patenting behavior are consistent with the mechanisms referred to by each side and their consequences for the rate and direction of innovation.

The two parts of the empirical analysis in the study complement the theoretical discussion in order to further our understanding of the heterogeneous effect of weakening the excludability aspect of patents on firm innovation for different types of stakeholders.

This study's contributions are also methodological. There are two common methodological challenges for studies estimating the impact of IP rights. The first issue is to control for rival hypotheses such as a technical breakthrough, regulatory capture, and industry- or country-level changes in order to isolate the effect of a change in IP rights' strength (Hall and Ziedonis, 2001; Kortum and Lerner, 1999). To consider the eBay case as an exogenous shock, I rely on the reaction of firms from a major foreign country that have stakes in the US market but are outside the US policy process. I use an exhaustive panel data set of patents matched with applicant information for French firms over the period 1996-2010. Using information about the patentees along with patent information, I analyze changes in the intensity of R&D investment and in the propensity to patent in reaction to this shock, as well

as changes in the composition of firms' innovative activities. A second common methodological issue is measuring patenting propensity – what an entity chooses to patent out of what is patentable. I use French firms' patents in their own country as the pool of patentable inventions and consider, among those inventions, the proportion that is filed in the United States. The variation in this ratio constitutes a measure closer to the concept of patenting propensity than existing ones, which is also robust to changes affecting the baseline number of patentable inventions. By examining firms' reactions in terms of patenting behavior and investments in R&D, I provide evidence that weaker patents do not necessarily lead to a decrease in innovation.

3.2 Background: A Shock on Patents' Ability to Exclude

Shifts in attitude towards patent holders and patent strength over time (c.f. Chapter 1) also affect the excludability aspect of patents. During the pro-patent period, attention is focused on the lack of incentives to innovate given by under-compensating patent holders in damages awards. In the following period of skepticism towards the exclusivity that patents confer, attention is focused on the risk of over-compensation hindering innovation and hurting consumers through hold-up problems and higher costs of conducting R&D. The shock used in the empirical analysis of this study occurred during this second period.

Given that inventions are created in new and unpredictable shapes, the government needs to adjust the law to adapt the patent system to changes in technology and in firm strategies. However, the fast pace of innovation relative to traditional policymaking in the elected branches of government and the need for the patent system to accommodate new technologies has led the judicial branch to become the key source of policy change for the past three decades (Merrill et al., 2004). When disputes arise, the courts alter the rules by setting legal precedents. This chapter studies the impact of Supreme Court-based policymaking, in

which decisions are made in the context of a unique case but create a rule that is applicable to all after the ruling has been made.

The eBay case occurred in 2006 in a patent system in which the exclusive right given to patent holders had been established in several parts of the legal system for over a century. The Constitution (Article I, clause 8) gives Congress the authority to award inventors with exclusive rights. The first Congress of the United States acted by adopting the Patent Act in 1790[21] (Seaman, 2015), by which patents give their owners an exclusive right to commercialize, perform R&D, and sell patented knowledge to others. Infringers received a fine until 1819, when Congress changed the law to allow granting injunctions:

> *"[T]he circuit courts of the United States . . . shall have authority to grant injunctions, according to the course and principles of courts of equity, to prevent the violation of the rights of any . . . inventors, secured to them by any laws of the United States, on such terms and conditions as the said courts may deem fit and reasonable."*[22]

When an injunction is granted, infringers are required to stop any activities related to the patented knowledge. In its interpretation of the law, the Supreme Court has considered injunctions automatic, at least since 1908:

> *"From the character of the right of the patentee we may judge of his remedies. It hardly needs to be pointed out that the right can only retain its attribute of exclusiveness by a prevention of its violation. Anything but prevention takes away the privilege which the law confers upon the patentee. If the conception of the law that a judgment in an action at law is reparation for the trespass, it is only for the particular trespass that is the ground of the action. There may be other trespasses and continuing wrongs and the vexation of many actions. These are well- recognized grounds of equity jurisdiction, especially in patent cases, and a citation of cases is unnecessary."* [23]

Lastly, the US Court of Appeal for the Federal Circuit (CAFC), which has been the *de facto* last court of appeals for patent-related cases since its creation in 1982, stated as early as 1983 that injunctions are automatic:

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[21] An Act to Promote the Progress of Useful Arts, ch. 7, § 1, 1 Stat. 109, 110 (1790)
[22] An Act to Extend the Jurisdiction of the Circuit Courts of the United States to Cases Arising Under the Law Relating to Patents, ch. 19, 3 Stat. 481, 481–82 (1819).
[23] Continental Paper Bag Co. v. Eastern Paper Bag Co., 210 U.S. 405 (1908)

> *"We hold that where validity and continuing infringement have been clearly established, […] immediate irreparable harm is presumed. To hold otherwise would be contrary to the public policy underlying the patent laws. […] Without this injunctive power of the courts, the right to exclude granted by the patent would be diminished…."*[24]

As a result, in terms of enforcement, for about a century before the eBay case, any entity found guilty of infringing on a valid patent was required to stop any activities using the patented knowledge. According to the legal literature (among others: Beckerman-rodau 2007, Kieff 2011, Mulder 2007), permanent injunctions were systematic, absent exceptional circumstances, upon infringement of a valid patent based on Richardson v. Suzuki Motor Co. (Fed. Cir. 1989). This rule was applied on entities that practiced the patent as well as non-practicing entities based on the precedent set by the Supreme Court decision Continental Paper Bag Co. v. Eastern Paper Bag Co., 210 U.S. 405 (1908). Therefore, when the Supreme Court agreed to take the eBay case, it opened the debate to revisit the interpretation of the Patent Act of 1819 despite the established jurisprudence.

On May 15th, 2006, the Supreme Court's ruling on the eBay case led to the loss of the automatic nature of injunctions in case of the infringement of a valid patent.[25] Gupta and Kesan (2017) analyze patent disputes after the eBay case to find that the permanent injunction grant rate dropped by 13% for non-practicing entities, while it dropped by 5% for practicing entities. They find that this drop for non-practicing entities was largely due to individual inventors, while patent holding companies were not affected differently compared to practicing companies. However, Gupta and Kesan (2017) find that the rate at which injunctions are sought decreased by 52% for practicing companies and by 86% for non-practicing companies.

In sum, before the shock, whenever the infringement and the validity of a patent were established, courts automatically ruled for an injunction. After the shock, injunctions were no longer automatic based on these two criteria alone.

[24] Smith International, Inc. v. Hughes Tool Company, 718 F.2d 1573 (CAFC, 1983)
[25] More details about the eBay case and its legal consequences available in an appendix A.

With this ruling, the exclusivity inherent to a property was weakened. This shock in 2006 was a court-imposed reduction in the ability of patent owners to exclude and enforce patents in the United States compared to the previous hundred years. I refer to this change as a "weakening of patents" in the rest of this chapter.

While the case was being litigated, there was a debate among stakeholders and the Supreme Court Justices regarding whether such a change would foster or hinder incentives to innovate. The debate that occurred mirrors the one occurring in the academic literature.

3.3 Theoretical Framework: Heterogeneous Effect of Weakening Patents on Innovation

Given the extent of divisions in the literature regarding the relationship between patent strength and innovation, there is still an open debate considering whether the effect of a decrease in the patent strength would stimulate or deter innovation (Aydin, 2015; Williams, 2017). Based on the existing literature, several mechanisms are expected to be at play, resulting in heterogeneous effects of weakening patents on innovation contingent on firms' technological fields, characteristics, and innovation strategies. To help frame the academic debates and to motivate and interpret the econometric findings below, I review the consistency of the outcomes anticipated by scholars with those expected by the stakeholders, based on an analysis of court documents obtained from the Westlaw database.

The documents include the opinion of the Supreme Court on the eBay case, the briefs filed by each party, and the 31 amicus briefs filed for the case by 151 amici (a subset is listed in Table 3). I identify the type of entities that take positions on each side of the debate and analyze each of their arguments based on the legal precedents cited. I exploit the relatively standardized format of legal precedent citations to systematize the examination of arguments. By scraping court documents, I obtain a data set of all the legal cases cited.

Among the 337 legal cases cited, I focus on the cases cited four times or more, which limits the list to the 38 most relevant cases of jurisprudence for a discussion on the excludability aspect of patents. Although the number of citations by case is relatively low (between 4 and 27), the information obtained on legal precedent citations complements a qualitative reading of the documents by providing a structure to guide the analysis of the content.

Among the amicus briefs, 13 briefs were filed in support of eBay and were in favor of the decision weakening patents, 14 briefs supported MercExchange and argued against weakening patents, and 4 did not take a side.[26] The most cited case on both sides was Continental Paper Bag Co. v. Eastern Paper Bag Co., 210 U.S. 405 (1908), in which the Supreme Court established that injunctions are automatic, and that the validity of a patent does not depend on whether it is practiced. The arguments made by each side focused on whether this rule should be changed.

Table 3 Sample of stakeholders in the eBay case

In favor of weaker patents	Against weaker patents
Research in Motion, Ltd	Pharma. Research and Manufacturing of America
Time Warner Inc.	Biotech. Industry Org.
Business Software Alliance	United Inventors Ass'n & Tech. Licensing Corp.
Yahoo! Inc.	Wisconsin Alum. Res. FDN
Electronic Frontier Foundation	Ass'n of American Univ.
Nokia Corp.	National Ass'n of State Colleges & Univ. Land-Grant Colleges
American Innovators' Alliance	American Bar Association
Intellectual Property Professors	Rembrandt IP Mgt, LLC
American Intellectual Property Law Ass'n (AIPLA) & Federal Circuit Bar Ass'n	Various Law & Econ. Prof.
	Qualcomm & Tessera
	General Electric

[26] Taking neither side, legal practitioners specialized in intellectual property recommended a status quo. A pharmaceutical company and an IT company argued that the principle of equity should be applied but that an injunction should not be granted based on whether the patent is exercised. There were no clear commonalities in the arguments used by these entities.

3.3.1 Weaker patents decrease innovation

First, against the decision weakening patents, companies and associations of companies with activities related to pharmaceuticals, chemicals, and biotechnology submitted 3 of the 14 amicus briefs (Table 3). Besides the firms in these industries, there were other amici whose business model relied on patent licensing. There were four amicus briefs submitted by small firms and inventors and two amicus briefs submitted by non-practicing entities including licensing firms, ventures, and universities' technology transfer offices. In addition, five amicus briefs were submitted by legal practitioners' associations and legal scholars. The US government and high technology large firms submitted the remaining amici. The data shows that this side argued that the right to exclude and its predictability are necessary for technology to be freely transferable and to maintain incentives to invest in R&D. For example, representatives of biotech firms made the following argument:

> *"The right to exclude others from practicing a validly patented invention provides the investment incentive that is essential for high-risk, high-cost biotechnology research and development. Increased unpredictability with respect to availability of exclusive right will greatly diminish the value of patent rights, […] reduce inventors' desire to promptly disclose inventions to the public and discourage the investment required to research and discover innovative technologies."*[27] *Argument by the Biotechnology Industry Organization (BIO)*

In the court briefs, eleven cases were highly cited to support two key arguments. Four cases[28] were cited to support the first argument, which was that patents are meant to provide a right to exclude. The second argument was that patents are needed to solve for the Arrow information paradox.[29] In addition to the eleven most-cited cases, frequently cited cases involved decisions

[27] Brief of Biotechnology Industry Organization as amicus curiae in support of respondent
[28] Dawson Chem. Co. v. Rohm & Haas Co., 448 U.S. 176, 215 (1980); Special Equipment Co. v. Coe, 324 U.S. 370, 378 (1945); Smith Int'l, Inc. v. Hughes Tool Co., 718 F.2d 1573, 1581 (Fed. Cir. 1983); Zenith Radio Corp. v. Hazeltine Research, Inc., 395 U.S. 100, 135 (1969); cited respectively by 10, 9, 6, and 6 briefs
[29] Crown Die & Tool Co. v. Nye Tool & Machine Works, 261 U.S. 24, 35 (1923); Foster v. American Mach. & Foundry Co., 492 F.2d 1317, 1324 (2d Cir. 1974)

in which injunctions were not granted despite established validity and infringement. Stakeholders referenced these cases to point out that circumstances related to extreme public interest issues different from the eBay case had justified the exceptional ruling.[30]

These arguments are consistent with key studies on innovation and patenting strategy. As tools for appropriation, the most obvious effect of weakening patents is that they will be used less by firms to protect their inventions. This is likely to have higher incidence on incentives to innovate for industries in which patents are important mechanisms of appropriation, such as discrete product industries working with pharmaceuticals, chemicals, and biotechnology (Cohen et al., 2000). The weakening of patents is also expected to affect firms that do not have the complementary assets to develop and commercialize the fruits of their research such as universities, public research organizations, small technology specialist firms, and private inventors. Sufficiently strong patents can ensure that the rent dissipation from disclosing knowledge and transferring it will be compensated by revenue (Arora et al., 2001; Arora and Gambardella, 2010; Aydin, 2015; Gans et al., 2008). Therefore, weakening patents is likely to lower the incentives for these types of firms to use patents as an appropriation mechanism and to invest in R&D.

Beyond what happens at the level of a given invention, there are two expected consequences of this decreased usefulness of patents as appropriation mechanisms. First, patents are used as a source of information with the disclosure of patented knowledge (Ernst, 2003). Therefore, if a given firm uses patents less, the amount of knowledge disclosed will decrease. Given the cumulative nature of innovation (Scotchmer, 1991), the decrease of knowledge spillovers may negatively impact innovation in other firms. Second, viewing patents as probabilistic appropriation mechanisms (Gallini, 1992; Lemley and Shapiro, 2005) helps

[30] Rite-Hite Corp. v. Kelley Co., 56 F.3d 1538, 1547 (Fed. Cir. 1995); Amoco Prod. Co. v. Village of Gambell, Alaska, 480 U.S. 531, 546 n.12 (1987)

understand potential changes in patenting strategy. A lower probability to succeed in protecting the patented knowledge for each patent can lead inventors to use more patents to protect a given innovation to compensate for the lower probability of success. This mechanism is likely to occur in technological areas in which components of inventions can be patented separately, such as in complex product industries (e.g. electronics). If such behavior is adopted, the cost of innovating will increase with the number of patents that must be filed and maintained, which will reduce incentives to invest in innovative activities.

In summary, if weaker patents increase rent dissipation in technology transfer, firms are both more likely to internalize commercial activities and to adopt costly patent-intensive behavior. Firms with lower resources are especially less likely to be able to adopt such changes to adapt to a weakening of patents (Blind et al., 2006). Therefore, based on the literature and the empirical evidence from court documents, a decrease in patent strength (excludability) is expected to result in a decrease in incentives to invest in R&D and a decreased patenting propensity for firms in discrete product industries and firms of any industry with relatively low resources such as SMEs.

3.3.2 Weaker patents increase innovation

On the other side of the debate, among the 87 amici supporting the decision to weaken patents, a technology field is clearly identifiable (Table 3). Nine out of the thirteen amicus briefs were submitted by large firms and associations of large firms in complex product industries, mainly in information technologies, finance, and electrical engineering. Fifty-six legal scholars and practitioners, as well as six interest groups related to legal issues and information technologies also made their arguments in 3 amicus briefs. The amici on this side point to the difficulty in navigating the patent thicket and the excessive use of injunctions that stifles incentives to innovate.

> *"Technology products typically consist of hundreds or thousands of patented components. It therefore is impossible for technology companies to investigate all of the*

patents, and pending patent applications, that may be relevant to a new invention, notwithstanding their best efforts to do so."[31] *Argument by Business Software Alliance et al.*

"Patent assertion companies use the threat of injunction to extract not an amount reflecting the value of their patented invention as used in the product or service, but the value to a company of being able to continue to use or sell the infringing product or service – which in many instances means the amount a company is prepared to pay to remain in business."[32] *Argument by Research In Motion (RIM)*

Based on a qualitative analysis of the arguments supporting weaker patents, I find that 16 cases were referenced frequently to support three key arguments. The first argument was supported by four cases [33] that highlight that the threat of injunction gives excessive leverage in negotiation. A second argument was supported by four cases[34] to point out that injunctions have not been used following a general rule, and three cases[35] were cited to advocate for a ruling proportionate to the offense. Third, two cases[36] were cited to emphasize the need to take public welfare into consideration. Stakeholders on this side painted injunctions as a penalty that is often unjustified and disproportionate. They point to "trolls" that use injunctions as leverage although they do not have research costs to recover and do not provide public benefits by commercializing patented inventions, especially in industries with complex products. Overall, entities on this side of the debate argue that strong patents make them vulnerable when facing patent holders and stifle their incentives to invest in R&D.

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[31] Brief of Business Software Alliance, Software and Information Industry Association, Information Technology Industry Council, and Information Technology Association of America as amici curiae in support of petitioners

[32] Brief of Research In Motion, LTD. as amicus curiae in support of petitioners

[33] Foster v. American Mach. & Foundry Co., (2d Cir. 1974); NTP, Inc. v. Research in Motion, Ltd., (Fed. Cir. 2005); Motion Picture Patents Co. v. Universal Film Mfg. Co., (1917); Nerney v. New York, N.H. & (2d Cir. 1936) cited respectively in 9, 4, 4 and 4 briefs

[34] Weinberger v. Romero-Barcelo, (1982); Rite-Hite Corp. v. Kelley Co., (Fed. Cir. 1995); Roche Prods., Inc. v. Bolar Pharms. Co., (Fed. Cir. 1984); Campbell v. Acuff-Rose Music Co., (1994); cited respectively in 9, 4, 4, and 5 briefs

[35] Weinberger v. Romero-Barcelo, (1982); Amoco Prod. Co. v. Village of Gambell, Alaska, (1987); Harrisonville v. W.S. Dickey Clay Mfg. Co. (1933); cited respectively in 9, 5 and 5 briefs

[36] New York Times Co. v. Tasini, (2001) Abend v. MCA, Inc., (9th Cir. 1988) both cited in 4 briefs

Consistent with the stakeholders' arguments, the literature finds that patent strategies for large firms in complex product industries, who argue for weaker patents, are very different from the firms that oppose weakening patents. In complex product industries, such as information technologies, a product or process is often fragmented. Fragmentation refers to components of a given innovation that are patented separately and held by different owners. As a result, when commercializing such an innovation, firms must "navigate the patent thicket"; in other words, they must manage the risk of being infringers (Shapiro, 2000). Firms bear the risk of being under "hold-up" by other patent owners, which increases the risk of investing in R&D (Clark and Konrad, 2008). In such technological areas, the use of portfolios of patents is common to strengthen a firm's position in cross-licensing negotiations and to threaten or defend against litigation. Ziedonis (2004) finds that firms in complex product industries tend to patent more under strong patent systems and that the effect is not specific to capital-intensive firms and is applied to firms that rely on "fragmented pools of external technologies." Therefore, the costs involved in building defensive patent portfolios are likely to decrease with weaker patents (Walsh et al., 2016).

For firms with resource constraints in fragmented industries, the expected effect of weakening patents is ambiguous. The study by Ziedonis (2004) suggests that we can expect this decrease in the size of patent portfolios to occur for firms regardless of the level of their resources. Nevertheless, previous studies have also found that resources matter in the ability to conduct strategic patenting (Blind et al., 2006), so SMEs are likely to hold fewer patents than large firms. Hence, the scale of the decrease in portfolio size may be smaller. In addition, fragmentation of intellectual property has a negative impact on innovative performance for firms with a small number of patents (Cockburn et al., 2010). Therefore, it is not clear that firms with a small patent portfolio in complex product industries will chose to reduce it further.

Lastly, given the cumulative nature of innovation, interdependence between inventions is not limited to complex product industries. An entity holding the initial patent of a stream of research (Galasso and Schankerman, 2014; Scotchmer, 1991) or holding patents on the necessary research tools (Walsh et al., 2003) may create hold-up situations and royalty-stacking issues.

Overall, the literature is consistent with the arguments in court briefs: incentives to innovate are stifled by strong patents in industries in which technologies are highly fragmented, such as complex product industries. Weaker patents can result in higher incentives to invest in R&D for the following three reasons. First, weaker patents reduce hold-up situations and make R&D investments less risky. Second, they decrease costs related to building patenting portfolios. Lastly, they allow spillovers from which other firms can benefit (Cohen et al., 2002; Hyytinen et al., 2015; Scotchmer, 1991). In terms of patenting propensity, firms that have enough resources to engage in building defensive patenting portfolios are likely to reduce that practice when patents become weaker. Therefore, a decrease in patent strength (excludability) can be expected to decrease the propensity to patent and increase incentives to innovate for large firms in complex product industries.

The *opinion* delivered by the Supreme Court shows that the Supreme Court Justices were more receptive to the arguments supporting the view that strong patents stifle firm innovation. The Supreme Court cited eight cases of which five were the top five most-cited cases by amici supporting the weakening of patents. None of the most highly cited cases used by MercExchange's side figure in the decision.

The *opinion* includes two sections in which Justices express different arguments supporting the same unanimous decision. In the second section,[37] Justice Kennedy, Justice

[37] The document is presented in more detail in an appendix available upon request.

Stevens, Justice Souter, and Justice Breyer highlight that taking circumstances into account is key. These four Justices justify the departure from previous decisions with the following differences in circumstances due to an evolving economic and technological context: first, the increasingly wide variations in the nature of innovations patented and the economic model of patent holders; second, the development of an industry in which injunctions are used as leverage to obtain excessive licensing fees, which is unrelated to the production and sales of new goods; third, this leverage is especially disproportionate in industries with fragmented technologies, in which the patent holder of a small component of a product can influence its commercialization; and, lastly, opportunistic behavior became more likely over the few years leading to the case because patents with unclear boundaries were granted, especially in business methods. The arguments regarding these changing circumstances are also supported by referencing the academic literature and reports. Among more than the 200 publications referenced, the report by the United States Federal Trade Commission (2003) is cited by 13 amicus briefs: 7 briefs on eBay's side and 4 on MercExchange's side. In contrast, most documents are only cited once and the number of citations for that report is more than twice the frequency of the second most-cited publication. In this publication, the FTC points to the development of an industry in which firms use patents to obtain licensing fees and not as a basis to produce and sell goods. The Supreme Court also refers to this document to highlight the disproportionate leverage injunctions given to some patent owners.

The qualitative analysis of stakeholders' positions shows that different types of firms expected their incentives to innovate to change in opposite ways following this shock, and studies in the literature support arguments on both sides. This motivates the critical test conducted in the empirical section of this study. The outcome of this critical test is made further uncertain because existing studies having established that patents are not an effective way for firms to

appropriate returns from innovation for most firms in several industries and business models. Mazzoleni and Nelson (1998) reviewed the literature supporting this claim and found that empirical evidence is consistent across the United States, Europe, and Japan and is not specific to a particular period (Arundel, 2001; Arundel and Kabla, 1998; Cohen et al., 2002, 2000; Levin et al., 1987; Mansfield, 1986). The authors found that firms use distinctive strategies according to their technology field. Only firms in some discrete product industries (pharmaceuticals and chemicals) use patents to protect profits directly (Cohen et al., 2000). Nevertheless, Cohen et al. (2000) point out that although patents by themselves are considered a weak protection in almost all industries, firms use patents in combination with other appropriability mechanisms. Therefore, there is uncertainty about "if" and "how" changing patents' excludability aspects will impact firm's innovation strategies. Firms may simply turn to other protection mechanisms, especially for large firms that have sufficient resources, and R&D investments could remain unchanged. Therefore, the following section makes a distinction between the effects of weakening patent strength on patenting behavior and on R&D investments.

3.4 Research Design

Key identification and measurement challenges can be summarized based on two seminal papers by Kortum and Lerner (1999) and Hall and Ziedonis (2001). These studies focus on another major case of changes in patent strength: the creation of the Court of Appeals for the Federal Circuit (CAFC) in 1982. This study's empirical strategy builds on the research design used by the two aforementioned studies.

Kortum and Lerner (1999) tested three rival hypotheses to explain a surge in patenting in the mid-1980s. First, the friendly court hypothesis explains the surge through the assumption that the CAFC is friendlier to patent holders than to alleged infringers. Second, the technological revolution hypothesis attributes the surge to scientific breakthroughs in a certain field. Third, the regulatory capture hypothesis suggests that the change in policy is the result of

lobbying, so firms that are most concerned with patenting will make changes beneficial for them. Hall and Ziedonis (2001) point out that this analysis should include firm characteristics because patent strategies vary by firm type. This second study finds that large firms with large fixed costs entered the patent portfolio race and small new firms with a focus on design became first-time patentees after the Texas Instrument lawsuit of 1985-1986 that signals the "friendliness" of the court to patent holders.

To estimate the impact of the shock on weakening patents in the US, the empirical strategy in this study consists in using a panel data set of firms from a foreign country. The country must have a large enough economy to include firms of various sizes and industries for several years before and after the 2006 shock. In addition, those firms need to have a significant share of their activities in the US to react but should be outside the US policymaking process for the shock to be considered exogenous.

Based on WIPO and the OECD, in 2006, France was the 9th largest economy based on gross domestic product, 4th in patent applications, and 13th in R&D spending. Firms of various sizes in both complex product industries (automobile, aerospace, IT) and discrete product industries (pharmaceuticals, chemicals) are observable in the French economy. As detailed below, I build a panel data set with firm characteristics matched with their patenting activities over 1996-2010. French firms have a significant share of their activities in the US: 29% of French patents were also granted in the US over the period 1996-2010 based on this data set. Therefore, firms are likely to react to an event in the US without being participants, which I verify in the court documents. Thus, the eBay case can be considered as an exogenous shock.

3.4.1 Data

The quantitative data set is a panel of the entire population of patents filed in France, the United States, and other countries by firms that operate in France, matched with a unique identifier with these firms' organizational, financial, and R&D characteristics between 1996 and 2010.

Examining the entire population ensures that there is no bias related to population specification, selection, or response.

I extract the population of patents filed in France by applicants based in France from Patstat (version 2016). Using patent family identification, I also collect information about whether these patents were filed in other countries. Patents filed by French firms, by law must be filed in France first for national security reasons, and need to obtain special authorization by the French defense ministry to do otherwise (Ministère de la Défense, 2014). Therefore, by keeping only patents that have been filed in France first, based on priority dates, the data focuses on inventions created in the country. The initial sample contains 170,990 patent applications filed by 17,389 applicants.

The French firm census data, collected jointly by the French Statistical Office (INSEE) and the Public Finance Administrative Office (DGFiP), contains annual financial information for the entire population of French firms over 1996-2007 and 2008-2010 in the FICUS and FARE databases,[38] respectively. The database "Contour des entreprises profilées" collected by INSEE provides information to further improve the information regarding firms belonging to the same enterprise (as defined by the 2008 law - Loi de modernisation de l'économie-LME) for 2009 and 2010. The data sets include a unique firm identifier attributed to every legal entity operating in France (the SIREN number).

The annual R&D survey conducted by the French Ministry of Higher Education, Research, and Innovation contains firms' R&D information over 1996-2010. The population for this survey includes all firms that are "likely to conduct R&D activities" in France. The survey identifies SIREN numbers in the fiscal administrative system to survey the entire population of firms with investments in R&D higher than EUR750,000. Other firms are

[38] There is a response rate of 100%, as these databases contain the census of firms collected through the fiscal administrative system.

surveyed as a sample. To avoid dropping observations, especially for small and medium firms, I impute an R&D budget of zero euros to firms that are in the database but are missing R&D information.[39] The rationale behind this decision is the following. First, the official justification given by the French Ministry for surveying about 11,000 entities per year rather than the entire population is that the entities performing R&D activities represent less than 1/200 of the entire population of firms in France. Second, the survey method mitigates the risk of imputing a budget of zero to new firms with R&D activities. Each year, the survey is updated to include firms that engage in R&D for the first time. They are identified using both their fiscal reporting of R&D investments for tax credits and the governments' records of applications for public R&D funding. This method has been iterated since 1990, therefore, from 1996 (the first year used in this study) the identification of firms "likely to conduct R&D activities" in France can be considered reliable. Lastly, the response rates for this survey range from 92% to 95% every year because firms face a fine when they fail to respond.

All of the above data sets include firms' SIREN numbers. I match them with an exact correspondence with Patstat based on a data set provided by the French patent office (National Institute of Industrial Property - INPI) that includes patent application numbers and SIREN numbers with an attribution rate between 96% and 98% for 1997-2010. As a result, I associate patents with the following applicant characteristics: size measured by the number of employees, and the indicator of belonging to a group, industry, and R&D budget.

Some observations have missing information. However, firms in France are legally required to answer these surveys. Therefore, I consider these errors as marginal and will work as if I had the entire population of patents filed by firms operating in France. Most of the observations dropped are patents filed by individuals or public organizations. I restrict the data

[39] Robustness checks using a random assignment of R&D budget for missing values instead of zeros (calculated based on industry average R&D investments and weighted by firm size) can be made available upon request.

set to firms that have filed at least one patent in France and to the period 1996-2010. This period is chosen for the following reasons. The lower boundary is based on a concern for reliability. The number of firms in the matched data set increases by about a thousand firms from 1995 to 1996. In comparison, variations between each year Y and Y+1 are on the order of a couple of hundred firms for all other years. Therefore, year 1995 is excluded. For the upper bound, while the data set could have been extended up to 2014, the Leahy-Smith American Invents Act (AIA) adopted in September 2011 introduced changes in various aspects of the US patent system. Scholars and policymakers' understanding of the effects of this recent and complex event is still incomplete. Therefore, while the study is limited by its inability to estimate the long-term impacts of the shock, the interpretation would require examining the AIA in such detail that is not in the scope of this study. The final sample includes 119,263 patent applications filed in France by 11,038 firms over 1996-2010.

Lastly, I use semi-structured interviews, conducted in September 2016, with IP officers in six large French firms among the CAC40[40] about their US patenting strategy focusing on the past 20 years. The goal in these interviews was to verify whether French firms monitor and react to changes in patent strength in the US, as well as to verify that the characterizations of patenting strategies by industry type (discrete vs. complex products) found in prior studies are also found among French firms.

3.4.2 Outcome measures

To overcome the challenge of not having a direct measure of innovation, I make inferences on the impact of changing patent strength on firm innovation by estimating the impact of the shock on two outcomes.

First, I use R&D intensity to operationalize firms' incentives to invest in innovative activities. R&D intensity is measured by the logarithm of the total R&D budget, adjusted to the

[40] Top 40 firms publicly traded in the French stock market.

value of euros in 2016, normalized by the number of employees of a firm i at year t (Hall and Ziedonis, 2001). The estimation of variations in this outcome is done for the sample restricted to the 4,526 firms that have patenting activities in the United States.

A key measurement challenge concerns the second outcome, patenting propensity, which is used as an indicator of innovation and appropriability conditions. Patenting propensity is defined as the proportion of patentable inventions for which a patent application is filed (Arundel and Kabla, 1998; Mansfield, 1986). Researchers have difficulty operationalizing the concept of "patentable inventions" because information about patentable inventions that are not patented is not available in the vast majority of cases. As a result, patent propensity has traditionally been measured using: 1) a direct survey question, which is subject to the disadvantages of self-reported data and high costs of surveying a large sample over time (MERIT survey in the Netherlands and SESSI survey in France), or 2) a ratio of patent applications over research and development (R&D) expenditure (Scherer, 1983), which does not control for the fact that the ratio between innovation and R&D investments varies widely across technology fields and firm type.

To address these challenges in estimating changes in patenting propensity, I use French firms' patents in their own country as a baseline of their patentable inventions. The propensity of patenting in the United States is determined by variations in the proportion of these patentable inventions filed at the United States Patent and Trademark Office (USPTO). This measure of patenting propensity is closer to the concept than previous studies and is robust to technology-specific, industry-specific, and country-specific changes that affect the baseline number of patents filed in France. In addition, to control for changes that could affect the ratio and not only the baseline number, the model includes a control for international patenting in other countries, as detailed below in the model specification section. This corresponds to ruling

out the technological revolution hypothesis (Kortum and Lerner, 1999) by controlling for events happening in France that affect patenting in the US as well as in other countries.

Rather than using a censored regression model for the propensity to patent that is a percentage, I choose to use a log-transformed dependent variable to obtain unbiased coefficient estimates and improve the ability of the model to fit the data. O'Hara and Kotze (2010), among others, show that count models perform better than log-transformed models. I also use count models to estimate the robustness of the results.[41]

As a result, patenting propensity is measured by the logarithm of the ratio of patents granted in the United States over patents filed in France. For a firm i in year t, the denominator represents the number of patents filed in France and the numerator of the ratio represents, among the patents filed in France, the number of patents also filed and granted in the United States. Grants are used for the United States because applications were not published for the first part of the period studied. The USPTO started publishing patent applications 18 months after they have been filed from late 2000 in accordance with 35 U.S.C. § 122. Although there are discussions about the exact number, the rate of patents that are granted in the United States is considered very high (Lemley and Sampat, 2008; Quillen, Jr. and Webster, 2001). Therefore, I chose to trade off the loss of precision from using grants with the precision gained in using a panel on a longer period.

3.4.3 Model specification

The model used to estimate changes in patenting propensity is at the firm level in a panel data framework. The specifications of this model build on a patent production function at the country-level model used by Kortum and Lerner (1999) that represents patenting from one country to another. That model decomposes the number of patents filed by applicants from one country, France in this study, to another country, the US in this study, at a date t, $p_{US\,FR\,t}$, into

[41] More detail about model selection in appendix B.

the following factors: the rate at which patentable inventions are generated in France ($\alpha_{FR\,t}$), the fraction of inventions from France that find use in the US ($\epsilon_{US\,FR}$), the propensity of patenting in the US ($f_{US\,t}$), which is a fraction of inventions that are worth trying to patent in the US out of those that have use there, and a globalization factor (g_t.).

$$\frac{p_{US\,FR\,t}}{\alpha_{FR\,t}} = f_{US\,t}\epsilon_{US\,FR}g_{FR\,t} \quad (1)$$

Kortum and Lerner (1999) impose two simplifying restrictions: 1) the propensity to patent $f_{US\,t}$ depends only on the US and 2) the usefulness of the technologies developed in France for the US market does not vary over time. The key arguments in this study support a relaxation of these assumptions.

The first key argument in this study is that a shock exogenous to a firm that changes patent strength can affect its decision to introduce technologies developed in France in the US market. This motivates the estimation of changes in patenting propensity over time and has consequences in terms of incentives to invest in R&D. Therefore, the shock is the key independent variable. $\mathbf{Shock_t}$ is a dummy equal to zero before 2006 and one after 2006. The variable is considered as missing during 2006 to provide a margin of about half a year before and after the event to estimate a clean reaction. This controls for the anticipation[42] of an uncertain event during the first half of the year until the decision on May 15th and the uncertainty regarding the enforcement of the decision by lower courts after the decision during the following half year. This implies that observations in 2006 are dropped when conducting the estimations.

[42] I conduct robustness checks testing for the possibility that the eBay case was identified as potentially important from the CAFC ruling. The first controversial decision to deny permanent injunction despite the infringement of a valid patent is made in 2003. I control for anticipation or uncertainty that could affect the results from 2003. Results in appendix G show that the effects on both patenting and R&D intensity are consistent.

The second key argument is that the effect of the shock on firms' innovation is expected to be contingent on their own characteristics. Therefore, this study also estimates the interaction between the shock and firm characteristics on patenting propensity and R&D investments. The theoretical discussion in section 3.3, based on the existing literature and an analysis of the court documents, indicates that large firms in complex product industries are expected to have a reaction different from other firms. A second key independent variable is therefore $\mathbf{Large\&Complex}_{it}$, a dummy capturing whether firm i is a large firm and belongs to a complex product industry. Being large is defined as having 500 or more employees, which is a standard way of defining this category (Cohen et al., 2000). Patents in complex product industries are identified based on patents' IPC classification. A firm is considered to belong to a complex product industry if over 50% of their patents belong to electrical engineering or mechanical engineering. Alternative tests based on the industry classification (ISIC codes with the first two digits between 30 and 39) used by Cohen et al. (2000) as well as with the fragmentation index proposed by Ziedonis (2004) both confirm the robustness of the results. The method based on patents is preferred because the importance of patenting in a given technology field is a better indicator for large firms whose activities are likely to be diversified in various fields.[43] Given the uncertainty regarding small and medium firms in complex product industries, I also examine the effects due to the complexity of the industry alone using the variable $\mathbf{Complex}_{it}$ and its interaction with the variable $\mathbf{Shock}_{t}$.

The Supreme Court made a decision in the eBay case that would be applicable to all firms in order to "adapt to the rapid technological and legal developments in the patents system." [44] However, the court documents show that firms expect to be affected in

[43] Robustness checks in appendix F restricting the analysis to patents in complex product industries are consistent with the main results on patenting propensity.
[44] Section of the opinion written by Justice Kennedy, Justice Stevens, Justice Souter and Justice Breyer.

heterogeneous ways, and the literature suggests that this may be right. Therefore, the goal of the quantitative part of this study is to estimate the effect of $\mathbf{Shock_t}$ and of $\mathbf{Shock_t} \times \mathbf{FirmType_{it}}$ (with firm type being either: $\mathbf{Complex_{it}}$ or $\text{Large\&Complex}_{it}$) on two outcomes: patenting propensity and R&D intensity.

To estimate the impact of weakening of patents, including firm fixed effects is more appropriate for examining the effect of $\mathbf{Shock_t}$, which changes over the period observed. Including fixed effects allows controlling for the time invariant characteristics of individual firms that may influence this effect and are not available in the data set. Therefore, I control for firm fixed-effects using official firm identifiers (SIREN). In addition, I control for R&D intensity, international patenting propensity, and competition in the United States, which are not time invariant.

On the other hand, a fixed effect model cannot be used to estimate the impact of $\mathbf{Shock_t} \times \mathbf{FirmType_{it}}$ because the investigation involves $\mathbf{FirmType_{it}}$, which can be considered time invariant in this study and is therefore collinear with firm dummies. While the measure is based on patents, it is likely to be relatively stable over time by construction. Therefore, the effect of the interaction term is estimated using random effect models controlling for relevant and observable firm characteristics. Based on previous work on firm innovation, and more particularly on the propensity to patent and the patent production function, it is reasonable to consider that the right-hand side of equation (1) varies with firm size, R&D intensity, industry, globalization, and affiliation with a business group (Crepon et al., 1998; Hall and Ziedonis, 2001; Hausman et al., 1984; Kortum and Lerner, 1999; Pakes and Griliches, 1980). As a result, for a firm i at date t, the ratio of the number of patents filed in the US ($p_{US\ FR\ it}$) out of those filed in France ($P_{FR\ it}$) is expressed by equation (2) with X_{jit} representing the characteristics j of firm i at date t. $\propto_j$ represents the elasticity of the patenting propensity to the firm level characteristics j and A is a constant.

$$\frac{p_{US\,FR\,it}}{P_{FR\,it}} = A \prod_j X_{jit}^{\propto_j} \quad (2)$$

If we set $\beta_0 = \ln(A)$, for each characteristic except size $\beta_{X_j} = \alpha_{X_j}$, and $\beta_{Size} = \sum_j \alpha_{X_j}$. A set of dummy variables captures industry-specific variations such as technological opportunities and business cycles.

In summary, the random effect models with patenting propensity as a dependent variable include the following control variables:

- **Large**$_{it}$: dummy for having 500 employees or more to represent the size of the firm
- **Complex**$_{it}$: represents the technology area of patents
- **Group**: dummy variable indicating whether the firm is an entity belonging to a business group. This variable accounts for the potential access to resources that are not captured by the size and R&D investments of the firm.
- **International** (also included in fixed-effect model): international patenting propensity for firm i at year t, measured by the logarithm of the maximum patenting propensity ratio among the top five destination countries for patent applicants, which are not North American nor European: China, Brazil, Japan, South Korea, and Australia. This variable controls for changes that occur in France, such as a technological breakthrough, and are bound to affect international patenting. This measure is based on patents, so it is compatible with a model that controls for firm fixed effects.
- **Competition** (also included in fixed-effect model): logarithm of the count of claims refused by the USPTO to a firm i in year t due to prior art based on existing backward citations of US patents.
- **Industries:** a set of 21 dummy variables based on the industry classification in the French industry code (Activité Principale Exercée - APE)

The model used to estimate the impact of the shock on R&D intensity is similar. The main difference is that the data set for each period is restricted to firms that have at least one patent

in the United States. The estimation controls for firm size, membership to a corporation, and industry. In addition, the model includes R&D intensity lagged by one year to capture path dependency in R&D investments. While controlling for time trends is clearly important, including time dummies is not compatible with the main independent variable, Shock_t, and is therefore kept only as a robustness check (Appendix C). Nevertheless, all results are compared with findings using this alternative model.

3.5 Findings

3.5.1 Description of the data

In the panel data, among the 119,263 patent applications filed in France by 11,038 firms, 72% were granted by the French patent office. This proportion presents an overall decrease from 89% in 1996 to 67% in 2010. Among patent applications in France, 29% were also filed and granted in the United States. Based on the original sample of 195,653 patent applications filed by 39,420 applicants, which include non-firms and firms with missing information, the trend is the same. Therefore, there does not seem to be a bias in the final sample for the overall trend.

The panel data set, which includes 24,678 firm-year observations, is unbalanced. About 75% of firms are one-time patentees. Only 5% of the firms are included for 7 years or more. The number of firms remains between 1,490 and 1,767 in each year over the period 1996-2010 with no clear trend. Based on firm-year units, large firms represent 17% of the sample. Their portion is on a decreasing trend from 19% in 1996 to 15% in 2010. Large firms make up 32% of the firms operating in France that have at least one patent in the US based on firm-year as a unit. Their representation in this group does not show a clear trend and the percentage varies between 28% and 36%. The rest of the sample is made of up of SMEs, which represent 83% of the population and are an increasing trend as patentees in France and make up 68% of the firms that have patents granted in the US. Two-thirds of the applicants are part of a business group, so this control variable is important for accounting for the resources and capabilities that are

not captured by firm size or R&D budget. Lastly, 18% of the firm-year observations indicate potential competition in the US market.

With firm-year as the unit of observation, the average propensity to patent in the US (unlogged) is about 19% over the whole period, with no clear trend (Table 4). The average R&D budget normalized by firm size (unlogged) is EUR8,400 thousand per employee, with EUR16,000 thousand per employee for large firms and EUR6,800 thousand per employee for small firms. When we only examine firms patenting in the US, the average R&D intensity overall for large firms and small firms is, respectively, EUR16,000 thousand, EUR 23,000 thousand, and EUR13,000 thousand. There are also no clear trends in variation of R&D intensity overall or for firms patenting in the United States. Nevertheless, a decrease in R&D intensity is observed in 2009, which is likely due to the 2008 financial crisis. Thus, a discussion of potential interactions with the results is provided in section **Error! Reference source not found.** below. The distribution of R&D intensity is highly skewed, with many firms with R&D budgets close or equal to zero. Therefore, R&D intensity in the regression models was measured using the logged values of normalized R&D budget. The propensity to patent in one of the top five non-North American or European countries is 71% on average, with a general increasing trend over the period.

Table 4 Descriptive statistics (N= 24,678 firm-year observations)

	Obs.	Mean	S.D.	Min	Max
Propensity to patent (not logged)	24,678	0.184	0.312	0	1
RDI (in thousand of EUR 2011 / employee- not logged)	24,678	8.361	44.108	0	2,818,381
Large	24,678	0.169	0.375	0	1
Complex industry	24,678	0.392	0.488	0	1
Group	24,678	0.660	0.474	0	1
Competition (logged)	24,678	0.179	0.427	0	5.337

Concerning firms on both sides of the debate, one could argue that multinationals operating in France and in the United States that make large investments in R&D and have ample resources will patent a new potential product/process in the United States regardless of changes in the patent system. In addition, such behavior could be expected to be more common for firms in industries in which patents are an efficient means of appropriation, such as in the pharmaceutical and chemical industries. Based on the interviews conducted with Chief IP officers in large French firms, I find that this behavior exists but is not consistent for all firms. While there was some variation in the interviewees' roles, they were all 1) the head of a department in charge of IP rights strategy for the corporation as a whole; and 2) their role included providing information related to the IP rights environment to the companies' executives.

For two out of the six firms interviewed, one in a complex product industry and one in a discrete product industry, changes in the United States did not explain their patenting propensity in a significant way.

> *"The largest change is upcoming, it is Brexit. The other changes like in the US patent system are only adaptations." (Interview with the chief IP officer of an aerospace corporation, September 2016)*

For the other four firms' IP officers, monitoring changes in US patent law is essential to be aware of threats and opportunities.

> *"Who could say that [they are not monitoring changes in the US]? If they say that, it's very suspect, especially if it's a company with an international market […] and that is not specific to the US. It's the same in China and everywhere in the world." (Interview with the Chief IP officer of an auto parts manufacturing corporation, September 2016)*

> *"We have a local team of US patent attorneys. […] We react to changes in the US. We can't ignore what the public arena is doing. Because it either creates opportunities or because it changes things and creates threats. It's our role to monitor that. We do it in Japan, in the US, everywhere. If there are changes, we will take them into account, it's part of our job." (Interview with the Chief IP officer of a chemicals manufacturing corporation, September 2016)*

In addition, some firms showed an awareness that the judicial branch is a key source of legal change for the US patent system.

> *"In Europe, the source of the law is the legislator. In the US, the legislator is the judge, with everything that is happening at the Supreme Court. Among other things, with computer technologies, we question the evolutions in the US." (Interview with the Chief IP officer of a chemicals manufacturing corporation, September 2016)*

The interviews reveal the extent to which a firm's sensitivity to changes in patent strength may be related to the firm's technology field. While further examination with more observations is needed to make generalizable claims, based on this small set of firms, it is clear that the behavior is not specific to complex or non-complex product industries. In terms of interpretation of the quantitative results, information from the interviews suggests that the size of significant effects of the shock found in the following subsections can be considered conservative because the existence of such behavior contributes to reducing the variance in the patenting propensity ratio and R&D intensity.

3.5.2 Effect of weaker patents on the rate of patenting and R&D investments

The dependent variable, a log transformed version of the ratio representing patenting propensity, is continuous and unbound. I use an Ordinary Least Square (OLS) estimator on the unbalanced panel data to estimate the effect of a decrease in patent strength. Based on the test devised by Hausman (1978), I find that model specifications with fixed effects are more appropriate than random effects (chi-squared(4)=522.05; prob>chi2=0.0000). Using a modified Wald test for group-wise heteroscedasticity in the fixed effect regression model, I find a heteroscedastic set of random variables (chi-squared(11,038)=1.3e+40; prob>chi2=0.0000) and use a robust estimator with standard errors clustered at the firm level (Stock and Watson, 2016). This specification is used in the first estimation model focused on the effect of the shock controlling for firm characteristics, including the unobserved ones, by using firm fixed-effects.

Accounting for firm fixed-effects can result in multicollinearity issues in subsequent tests that examine the impact of the shock in interaction with time-invariant firm characteristics. Therefore, estimation models that examine the impact of $\mathbf{FirmType_{it}}$ and $\mathbf{Shock_t} \times \mathbf{FirmType_{it}}$ are OLS random effect models, also using the robust estimator, and controlling

for observable firm characteristics listed previously in section 4.3. The correlation matrix (Table 5) shows that there are no multicollinearity issues and the explanatory and control variables are indeed related to the propensity to patent and R&D intensity.

Table 5 Correlation matrix (as included in the models' estimations, N= 24,678 firm-year observations)

		1	2	3	4	5	6	7
1	US patenting prop.	1						
2	Complex prod. ind.	-0.0131*	1					
3	Large	0.1822*	0.0674*	1				
4	R&D	0.2632*	0.0431*	0.2890*	1			
5	Group	0.0928*	0.0020	0.1703*	0.1814*	1		
6	International	0.5034*	-0.0529*	0.1418*	0.2143*	0.0579*	1	
7	Competition	0.1013	0.0559*	0.2942*	0.2609*	0.0611*	0.0827*	1

Note: * significant at the 0.05 level.

Based on the results of the estimation of model 1 in Table 6, I find a negative and significant effect of the shock weakening patents on the propensity to patent. Holding other things equal, the propensity to patent decreases by 2.3 percentage points.[45] This is consistent with the 3 percentage-point decrease found by Aydin (2015). Firms in both complex and non-complex product industries decrease their rates of patenting in reaction to the shock, and the effect does not differ between the two types of industries (model 2 in Table 6). However, the decrease is significantly larger by 2.5 percentage points for large firms in complex product industries (5.1) compared to other firms (2.6) holding other factors constant (model 3 in Table 6). While the models are different and therefore not directly comparable, robustness checks accounting for time trends suggest that these results are conservative. The effect found by adding year dummies to the same regression model is close to an 8.7 percentage-point decrease.[46] The

[45] Models 2 and 3 as well as 5 and 6 are used to examine the relative difference between groups of firms. The size of coefficients in these models cannot be compared to model 1 and model 4, respectively, because the specifications are different (controls and fixed effects).
[46] Appendix C.

difference between large firms in complex product industries compared to other firms is also significant and of comparable size when including year dummies in the model: the decrease is larger, by 6.1 percentage points instead of 6.2 percentage points.

The decrease in patenting propensity for large firms in complex product industries cannot be interpreted as a simple decrease in the ability to use patents to protect inventions from rivals for the following reasons. First, this interpretation is inconsistent with the finding that the decrease is significantly larger for firms that argued in favor of the change compared to those that argued against it. Large firms in complex product industries would not be supportive of a change weakening this aspect of patents if their main use of patents depended only on their ability to exclude others. Second, arguments in the briefs filed by the amici supporting weaker patents point out the need to reduce the threat of litigation and of injunction coming from other firms and especially non-practicing entities. They show more concern about their vulnerability when facing other patent holders than the potential reduction of their ability to prevent others from stealing their own inventions.

Therefore, the decrease in patenting propensity observed for large firms in complex product industries can be interpreted as a decrease in the need to file for patents with the purpose of building strategic patent portfolios for defensive reasons.

On the other hand, the results of the estimation show that the shock decreased the patenting propensity of firms other than large firms in complex product industries, by a smaller size (model 3 in Table 6). The smaller size of the effect may be attributed to the lower likelihood that these firms will build defensive patenting portfolios compared to large firms in complex product industries (Bessen, 2003; Blind et al., 2006; United States Federal Trade Commission, 2003). Therefore, the scale of the change is bound to be smaller for any given mechanism. The negative effect can be explained by firms on this side of the debate using patents to protect profits directly from licensing activities or commercialization based on the patented knowledge.

The analysis of court documents shows that opponents of weaker patents argued that the right to exclude and its predictability are necessary for technology to be freely commercialized and transferable. Patents are used to protect profits from commercialization directly in "discrete" product industries in which products are made of a small number of patentable elements (Cohen et al., 2000), as opposed to "complex" product industries in which patents are involved in indirect methods of protection through negotiations with other actors using patent portfolios. In addition, entities that sided against weaker patents also argued in the court briefs that decreased excludability would hurt their ability to manage patented technologies outside of the firm's boundaries. This finding is consistent with the view that small and medium firms rely on patents to secure revenues from out-licensing technologies for which they do not have the complementary assets to commercialize internally (Arora and Ceccagnoli, 2006). Aydin (2015) found that the decreasing out-licensing following the eBay case was more pronounced for small and medium firms.

Firms on the side that opposed weakening patents argued from the position of patent holders rather than that of potential infringers. The negative effect on patenting propensity can be explained by a lower incentive to use patents to exclude others from using proprietary knowledge (Cohen et al., 2000; Mansfield, 1986).

To provide evidence regarding the meaning of this decrease in patenting propensity in terms of firms' incentives to invest in R&D, I estimate the effects on the second outcome. I examine R&D intensity, which is the logged value of R&D budget normalized by firm size. I limit the data set to firms that have at least one patent in the US in the given year to ensure that firms have a reason to react to the shock that occurs in the US. I use a similar OLS model controlling for firm fixed-effects and correcting for issues of heteroscedasticity with a Whyte estimator to estimate the impact of the shock. I also use a random effects model controlling for additional

time-invariant firm characteristics to estimate the impact of the shock in interaction with firm type.

The empirical analysis shows that there is no negative effect of the shock on innovative activities. On the contrary, it shows a positive and significant effect (model 4 in Table 6).[47] This increase in R&D intensity is positive for both groups (model 6 in Table 6). However, the effect of the shock for large firms in complex product industries is b_{LC} = 0.0775 (sum of 0,2098 due to the shock for all firms and of -0,1323 specific to this group of firms from model 6 in Table 6) with a z-score of 1.0503 that indicates the effect is not positive but not significantly different from zero. The remarkable result is that the increase in R&D intensity due to the shock is smaller for large firms in complex product industries, b_O = 0.0775, compared to the positive and statistically significant effect of 0,2098 percentage point increase in R&D for other firms (comparison of b_{LC} and b_O in Figure 4). This result is surprising since large firms in complex industries can be expected to have higher incentives to invest in innovative activities following their win in court. As examined in further detail in the following section, the larger increase of R&D intensity presented by other firms seems to be due to costs in shifting the direction of their innovative activities, that involved a larger increase in R&D investments than the one due to the increased incentives to innovate of large and complex firms on the winning side.

The findings are consistent, and the positive effect is larger, when using the logarithm of the number of patent applications in France as an alternative measure of lagged R&D intensity. This sensitivity check is conducted to capture previous R&D intensity with a proxy that exists for one-time applicants. Patent applications can be used as the proxy because they come with a delay after performing the R&D, but they can also capture the extent to which the output of R&D of that firm depends on patenting.

[47] Models 2 and 3 as well as 5 and 6 are used to examine the relative differences between groups of firms. The size of coefficients in these models cannot be compared to model 1 and model 4, respectively, because the specifications are different (controls and fixed effects).

Given that this effect potentially concerns all French firms, I conduct two additional tests. First, I conduct a difference-in-difference analysis of the change in R&D intensity between firms that patent in the US compared to firms that do not. I find that firms that patent in the US increase their R&D investments significantly more than firms that do not, following the shock (Figure 5). There remains the concern that this effect may proceed from a global event that affects all French firms that patent internationally. Therefore, I conduct an additional placebo test by restricting the sample to French firms that do not patent in the US. I use a difference-in-difference approach to test the effect of the shock between firms that patent in Japan and those that do not. I repeat this exercise with the top five destination countries for French patentees and find no evidence of an effect. The results are kept as an indicative model rather than as the main model because there is a probable bias. Firms that have activities in the US are likely to be more successful and endowed with more resources on average than firms that only operate nationally. The effects estimated using models 4, 5, and 6 modified by adding time dummies show that these results are consistent when accounting for time trends. While the models are not directly comparable, the effect of the shock on R&D intensity is significant, positive, and of a larger size by 2 percentage points compared to the result in model 3 in Table 6.

The interpretation of the positive (yet not significant) increase in R&D intensity is straightforward for large firms in complex product industries, and the result is consistent with the theoretical discussion. The threat of the penalty for a firm that becomes an alleged infringer decreases with weaker patents and improves firms' abilities to navigate the patent thicket (Shapiro, 2000). As a result of lower risk, firms have incentives to increase their R&D activities. However, the evidence of a non-significant increase found in this study shows that they do not increase investments in a significant manner. Nevertheless, the decreased risk reduces the need to build a preemptive patenting portfolio, which is consistent with the decrease observed in

patenting propensity. The resulting reduction in innovation costs related to patenting may also lead to higher incentives to invest in R&D activities.

The more surprising result is the positive and larger effect for firms in other industries that argued against the decision. Investments in R&D increase, and this increase is even larger than for large firms in complex product industries (models 4, 5, and 6 in Table 6). To explain this change in the rate of innovative activities for firms on the losing side, I further examine the direction of innovation, focusing on the composition of R&D investments, the types of inventions that are patented, and the types of firms that engage in patenting.

Table 6 Effect of weakening patents on firms' propensity to patent and R&D intensity (unit of observation is firm-year)

OLS	**Patenting Propensity**			**R&D intensity**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Shock	-0.0233***	-0.0328***	-0.0257***	0.2643***	0.1554***	0.2098***
	(0.004)	(0.004)	(0.003)	(0.048)	(0.046)	(0.040)
Complex		-0.0080**			0.0143	
		(0.004)			(0.049)	
Shock*Complex		0.0145**			0.0601	
		(0.006)			(0.066)	
Large&Complex			0.0467***			0.1233**
			(0.008)			(0.052)
Shock*						
Large&Complex			-0.0249*			-0.1323**
			(0.013)			(0.062)
Large		0.0435***			0.1612***	
		(0.005)			(0.048)	
R&D intensity	-0.0004	0.0200***	0.0210***			
	(0.002)	(0.002)	(0.002)			
Group		0.0077**	0.0099***		0.1496***	0.1569***
		(0.003)	(0.003)		(0.044)	(0.044)
International	0.4482***	0.5821***	0.5879***	-0.0232	0.1773**	0.1765**
	(0.014)	(0.011)	(0.011)	(0.103)	(0.084)	(0.085)
Competition	-0.0146***	0.0026	0.0069	0.0366	0.1120***	0.1248***
	(0.004)	(0.005)	(0.004)	(0.037)	(0.029)	(0.029)
R&D intensity t-1				0.2554***	0.5271***	0.5308***
				(0.035)	(0.022)	(0.022)
Firm FE	Yes	No	No	Yes	No	No
Industry FE	No	Yes	Yes	No	Yes	Yes
Constant	0.1142***	0.0616***	0.0590***	1.3094***	0.3972***	0.4018***
	(0.003)	(0.009)	(0.009)	(0.070)	(0.142)	(0.141)
Obs	23,132	23,132	23,132	3,991	3,991	3,991
# firms	10,688	10,688	10,688	1,418	1,418	1,418
R-squared	0.244	0.29	0.2924	0.558	0.592	0.592
Prob > stat	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: * significant at 0.10, ** significant at 0.05, *** significant at 0.01. Standard errors are in parentheses. N is smaller than 30,766 because: 1) observations are dropped for 2006 due to the construction of the Shock variable; 2) for models 4-6, the sample is restricted to firms patenting in the US.

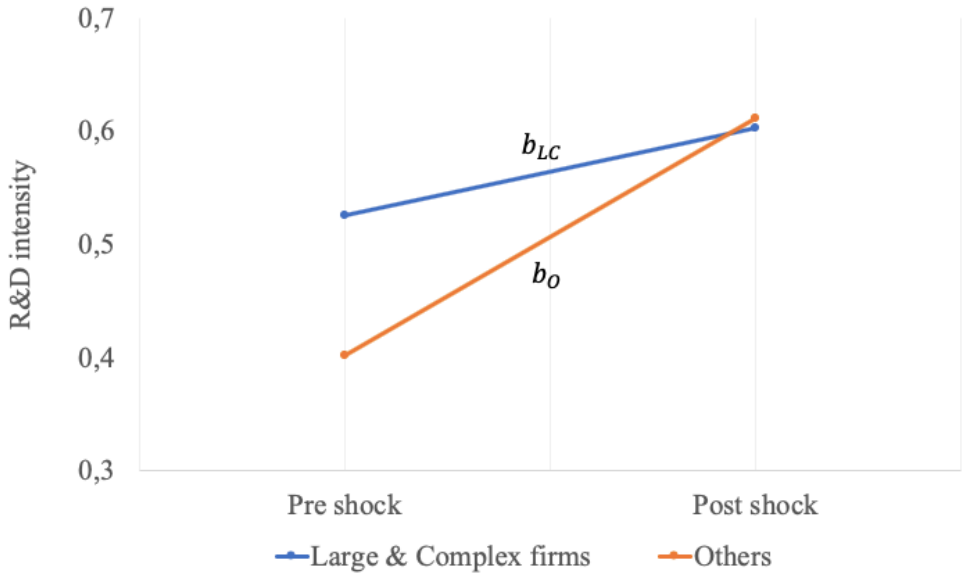

Figure 4 Effect of the shock on R&D intensity

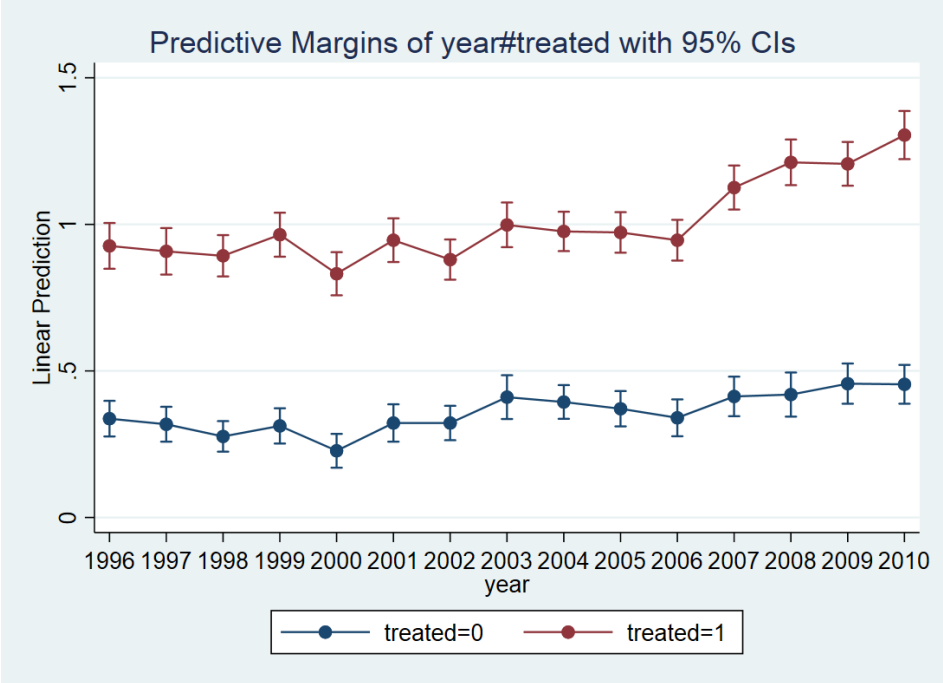

Figure 5 Difference-in-difference in R&D investments between French firms that patent in the US and French firms that do not.

3.5.3 Effect on the direction of innovation

First, I examine whether there are changes in the composition of innovative activities for large firms in complex product industries. I focus on the quality of the inventions patented based on forward citations as a measure representing technological impact on subsequent inventions. Given that this step focuses on patent-level information, I structure the data set to examine patent-year as a unit of observation rather than firm-year.

I operationalize quality as technological impact using forward citations minus the citations added by examiners (Moser et al., 2017). Moser et al. (2017) compares citing practices for patents on hybrid corn using field trial data as measures of objective performance. I subtract examiner citations because Moser and her co-authors find that examiner-added citations are a poor predictor of performance improvements. This measure is a "one size fits all" solution that has only been tested on a particular technology (hybrid corn); thus, generalizing it to all technologies presents limitations (Kuhn et al., 2016). While operationalization could be improved by using empirical techniques tailored to different types of patented technologies as argued by Kuhn et al. (2016), this exercise is not in the scope of this study and this measure is used for the sake of simplicity.

High-quality inventions are operationalized using a dummy representing whether the number of forward citations five years after the patent was filed is above the 75^{th} percentile in a given year in its technology field based on IPC classification. Low-quality inventions are captured by a dummy that indicates whether the patent is within the lowest 25^{th} percentile in terms of citations in its year of filing and technology field. I use a difference-in-difference approach to estimate the impact of the shock on the outcomes between French firms that patent in the US and those that do not.

I find that after the shock weakening patents, the quality of the patents filed by large firms in complex product industries increases, on average. I examine the extremes and find that this increase in average is driven by a decrease in the number of low-quality patents (Table 7). This result is robust to using patents with zero citations within the five years following the filing date as a measure of low-quality patents. This is consistent with the interpretation that the decrease in the size of the portfolio of large firms in complex product industries is due to a lower need for defensive patenting.

Table 7 Patent quality for large firms in complex product industries (patent-year level)

	Quality	Top Quality	Low Quality
Treatment × Shock	0.493 (0.071)***	-0.049 (0.000)***	-0.101 (0.012)***
Industry FE	Yes	Yes	Yes
Covariates	Size, Group, Int'l, Competition	Size, Group, Int'l, Competition	Size, Group, Int'l, Competition
# observations	35,883 (12,025 treated)	35,883 (12,025 treated)	35,881 (12,025 treated)
R-Squared	0.03	0.09	0.04

Note: * significant at 0.10, ** significant at 0.05, *** significant at 0.01. Standard errors are in parentheses.

The question remaining is: why do firms that argued that they would lose incentives to invest in innovation following the weakening of patents actually increase their R&D investments? I explore two potential explanations.

The most straightforward potential explanation is that given by the stakeholders in court briefs. The shock reduces existing firms' abilities to appropriate the returns from their innovative activities and, as a result, some of such firms lose their incentive to invest in R&D. In that case, the observed increase in R&D investments is due to other firms seizing opportunities created by increased spillovers allowed by weaker patents or from incumbents' lower patenting propensity, leaving gaps of patentable knowledge available to be patented by

new entrants (Cohen et al., 2002; Scotchmer, 1991). I conduct a difference-in-difference test using firm-year as the unit of analysis to examine, among firms on the losing side of the case (all but large firms in complex product industries), whether the number of first-time patentees increases after the shock for firms that patent in the US compared to firms that patent only in their home country. I find evidence that the number of first-time patentees decreases significantly after the shock (Table 8). This result does not support the first potential explanation and indicates that if opportunities are created by the shock, they are not captured by firms that engage in patenting for the first time.

Table 8 First time patenting (firm-year level)

	First time patenting
Treatment × Shock	-0.036 (0.009)***
Industry FE	Yes
Covariates	Size, Group, Int'l, Competition
# observations	21,300 (11,531 treated)
R-Squared	0.198

Note: * significant at 0.10, ** significant at 0.05, *** significant at 0.01. Standard errors are in parentheses. Excluding large firms in complex product industries.

A second potential explanation for the increase in R&D intensity is that, contrary to the threat firms made in their court briefs, they do not lose their incentive to invest in innovative activities. However, given the new level of patent strength after the shock, more efforts in innovation strategy are required for firms to generate the same value from innovative activities. Therefore, the increase in R&D intensity reflects higher costs rather than a change in incentives to innovate. I examine changes in the quality and the novelty of outputs of firms' innovative activities on the side that argued against weaker patents.

First, I find that contrary to the winning side (large firms in complex product industries), firms on the losing side do not significantly change their patenting behavior for low-quality patents in terms of technology impact. Based on a difference-in-difference test between patents filed in the US and those filed only a firm's home country, with a sample restricted to patents owned by firms on the losing side, on average, firms increase the number of their top-quality patented inventions in terms of technological impact using the measure based on forward citations used previously (models 3 and 4 in Table 9).

Second, I examine novelty by testing changes in the production of inventions that belong to technology areas in which the firm had no prior patents, using the IPC classes for patents owned by each firm going back to 1975. I find a significant increase in the number of patents filed in technological areas new to the firm for firms that experience the shock (model 4 in Table 9). As an alternative measure of novelty, I account for whether a firm's patent is on a follow-on invention by measuring if it cites at least one of their own patents, using all the patents owned by firms from 1975. I find that the number of self-citing patents decreases after the shock for those filed in the US compared to those filed in France only (model 5 in Table 9). This indicates that following the decrease in exclusivity conferred by patents, firms that argued against this change engage more in innovative activities for which they do not own the knowledge they build on, such as exploratory research (March, 1991).

Regarding changes in the composition of inputs, the quality of the data does not allow meaningful statistical analysis. The data set includes: 1) amount of R&D expenditure dedicated to basic and applied R&D and amount of R&D expenditure dedicated to development, with the sum being equal to total R&D expenditure; and 2) amount of internal R&D and amount of external R&D, the sum being equal to total R&D expenditure. After removing missing values, the sample size is less than a third of the original sample of over 23,132 firm-year observations. A difference-in-difference test between firms that patent in the US and firms that do not shows

that both upstream R&D and external R&D increase (amounts normalized by firm size and logged).

The increase in upstream R&D could indicate a shift towards higher value R&D activities. The increase in external R&D can be interpreted in two ways. This result could be consistent with firms moving to technological areas that are new to them and the need to rely on external knowledge acquisition to learn. However, another interpretation of this result is that firms are outsourcing the burden of determining whether an invention can be protected with patents under the new regime. In this view, rather than producing the inventions internally, they chose to acquire inventions that other firms have decided to patent and transfer. The level of detail on external R&D investments does not allow testing between these hypotheses. In addition, the results on the composition of R&D are based on a simplistic analysis of a limited data set and should be considered with some caution.

Table 9 Quality and novelty of patented inventions (patent-year level)

	Quality	**Top Quality**	**Low quality**	**New technological area**	**Follow-on invention**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Treatment × Shock	-0.070 (0.190)	0.084 (0.000)***	-0.009 (0.309)	0.102 (0.000)***	-0.018 (0.000)***
Industry FE	Yes	Yes	Yes	Yes	Yes
Covariates	Size, Group, Int'l, Competition	Size, Group, Int'l, Competition	Size, Group, Int'l, Competition	Size, Group, Int'l, Competition	Size, Group, Int'l, Competition
# observations	75,758 (19,105 treated)	75,758 (19,105 treated)	75,758 (19,105 treated)	75,758 (19,105 treated)	75,758 (19,105 treated)
R-Squared	0.016	0.124	0.023	0.158	0.005

Note: * significant at 0.10, ** significant at 0.05, *** significant at 0.01. Standard errors are in parentheses. Excluding large firms in complex product industries.

Each of the results on the composition of outputs and inputs of firms' innovative activities on the losing side of the eBay case are simplistic difference-in-difference tests that are insufficient for making strong causal claims. Nevertheless, while these results are weak as standalone evidence, the accumulation of these observations is consistent with the second explanation for the increase in R&D investment. Firms that argued against the weakening of patents incur higher costs in R&D to shift their innovative activities towards higher potential value (upstream R&D and higher quality in terms of technological impact) or new sources of value (new technological areas and less follow-on inventions) to adapt to the disadvantageous change in the patent system created by the shock. This increase in costs may explain why firms argued in court against the weakening of patents. While firms argued that a consequence would be a loss of incentives to innovate, the observed reaction of firms based on the quantitative evidence is actually not entirely surprising. Their willingness to incur higher costs to continue innovating is consistent with the fact that innovation is a key source of competitive advantage in the knowledge-based economy in which firms operate.

The results support a shift in the composition of inventions patented to adapt to the change in appropriability reducing the exclusivity that patents provide. These findings are consistent with Moser's (2005) work considering World Fairs in several countries, which found that while patents are not critical for firms' incentives to innovate, they have a significant effect on inter-industry differences in the rate and direction of innovative activities.

3.6 Discussion

Although the research design proposed in this study offers several advantages, concerns – mostly related to using the reaction of foreign firms – can remain. The key robustness checks conducted to address these concerns are the following.[48]

First, the variable capturing international patenting and, by construction, the measure of patenting propensity controls for changes specific to French firms. To further alleviate the concern regarding the specificity of the French case, I estimate the changes in French firms' propensity to patent in countries other than the US over the same period to ensure the reliability of these findings (Appendix D). I find that the propensity of patenting decreases by 0.3% in Korea and Taiwan, which is ten times smaller than the change due to weakening patents in the US. A decrease by 1% is observable in the United Kingdom, which is about a third of the size found in the US.

Second, events that potentially interact with the shock may be also located in the US. Two points need to be considered. The first is the existence of the International Trade Commission that still grants permanent injunctions on imported products when valid patents have been infringed. This makes the results in this study more conservative for firms that manufacture and import their products to the US that could experience either a status quo or a deterrence for investing in innovation due to the shock. The second is the Supreme Court case KSR International Co. v. Teleflex INC (550 U.S. 398, 2007) in 2007, the decision of which rendered the combination of two elements unpatentable if the combination is obvious, which can be proven by the combination's existence at the time of invention of the elements. Although this case could have had impacts on the machine industry, it has not been found to have clear effects on the patent system (Petherbridge and Wagner, 2007). In addition, while the decrease in patenting propensity may partly be explained by this event, the potential effect of this change

[48] Other additional robustness checks are detailed in an appendix available upon request.

on R&D investments is negative, which makes the size of the effect found in this study on this outcome more conservative.

Third, while using the reaction of foreign firms helps control for the rival hypothesis called "regulatory capture" by Kortum and Lerner (1999), the US patent system may not be completely hermetic from French firms' influence. As one French IP officer told me:

> *"Industrial actors really try to talk to each other to influence public policies." (Interview with the chief IP officer of an international manufacturing corporation in a discrete product industry, September 2016)*

One of the interviewees mentioned having previously worked on initiatives to harmonize the rules in meetings between IP5 (the top five patent offices in the world) and major industrial actors every two to three years. According to the interviewee, such meetings once included David Kappos, who was employed by IBM and later became Undersecretary of Commerce for Intellectual Property and Director of the United States Patent and Trademark Office (USPTO). The potential existence of such indirect effects has to be acknowledged as a limitation of the research design in this study. Gaining a more precise understanding of French firms' influence on the US patent system through these interactions would require a deeper investigation that is beyond the scope of this study.

In addition, a key challenge is to distinguish between time trends and the effect of the shock on patent strength. All results are robust to including year fixed effects to account for trends (Appendix C), which were not included in the main models because of the collinearity issue with the variable capturing the shock.

The effect of the 2008 financial crisis is also of specific concern for time trends. First, robustness checks controlling for the crisis using a dummy variable are consistent with the findings (Appendix E). Second, for firms patenting in the US, the highest average R&D intensity was reached in 2007 with EUR225 thousand per employees. Decreases to EUR187 thousand in 2008 and EUR88 in 2009 were observed. However, the level in 2010 showed an

increase almost back to the pre-crisis level at EUR186 thousand. Considering the results of this study, the decrease in patenting propensity found following 2006 may be due to considerations of cost reduction in patenting related to the financial crisis. On the other hand, the effect of the event on R&D intensity should be negative, which suggests that the size of the positive effect of weakening patents on R&D investments found in this study is conservative.

There are also limitations in terms of generalizability of the results to the relationship between patent strength and innovation. While the shock leveraged a change in one of the defining aspects of intellectual property, it is focused on a particular tool (automatic injunctions) within an aspect of the strength of patents (the ability to exclude). The threat of injunction is relevant only if the potential cost is superior to going to court and being imposed an injunction. Firms might be leery of going to court to test this new limitation in the patent right:

> *"Yes, they can't get injunctions anymore, but it's still less expensive to settle than to go to court. […] The cost of litigation in the US is between 3 and 5 million. So if someone asks us one million, we will pay the one million because we're not certain to be able to invalidate the patent." (Interview with the Chief IP officer of a manufacturing corporation in optics and other materials, 2016)*

Therefore, for firms that have the ability to pay, the eBay case may have no effect when the knowledge they are accused of infringing has a value lower than the cost of litigation. This suggests that the changes in patenting and R&D investments found in this study are conservative because these cases contribute to reducing the variance.

Lastly, it is worth noting that the eBay case occurred in the context of a given initial level of patent strength. This level of strength, based on the review of the academic literature and policies, can be considered high. The empirical outcomes that may be associated with further reductions in patent exclusivity are unclear.

The results of this study build on the existing literature combined with empirical evidence from the eBay case to provide new insights on the effects of excludability through IP

rights. A lower ability to exclude others from using patented knowledge pulls the nature of patents away from a property by definition. Therefore, this study provides evidence of the impact of a change in a key aspect of the patent system. The findings are generalizable to other aspects of patent strength to some extent. Patentability and breadth are the two other aspects of the three-dimension categorization proposed by Walsh et al. (2016). Given a certain level of excludability X, a change in patentability on a subject matter is a change between zero and X in terms of excludability for the given subject matter. Depending on the technological area of the subject matter and the firm type, the results of this study are applicable in a straightforward way. On the other hand, the generalizability of these results to a change in the breadth of interpretation of claims, which translates into how close a rival's invention can be without infringing on a patented invention, is not straightforward and calls for a more cautious and extensive discussion.

3.7 Conclusion

The existing literature has already significantly extended our understanding of the mechanisms involved in firms' patent strategy and the relationship between patent strength and innovation. These mechanisms have been studied from both sides of the on-going debate regarding this relationship. Therefore, the approach in this study consists in using the qualitative empirical evidence as a starting point to identify which of these existing insights are the most relevant to improving our understanding of the understudied aspect of excludability.

This study supports each theoretical contribution with carefully designed empirical methods and rich data sets that aim to advance the state of the art in research designs to address this question. The research design solves for common identification and measurement issues by examining foreign firms' reactions to a shock in the US. The use of mixed methods and the exhaustive population panel data allows this study to produce empirical evidence and make robust interpretations of the results concerning the mechanisms involved.

The findings of this study provide evidence that a decrease in patents' ability to exclude can lead to more investments in innovation alongside a reduction in patenting. The uniform rate observed across firm types is explained by different underlying mechanisms contingent on industry and resources.

For large firms in complex product industries, this study finds that a reduction in patents' ability to exclude has the following consequences. First, as the result of a lower risk when facing other patent holders and lower costs incurred in building a patenting portfolio, such firms have higher incentives to invest in innovative activities. Second, patenting propensity decreases due to a decrease in the need for preemptive patenting. The quality of patents in the portfolios of large firms in complex product industries increases due to a reduction of the patents with low technological impacts used for preemptive purposes.

On the other hand, for SMEs and for firms in non-complex product industries, a reduction in the ability to exclude others from using patented knowledge has very different consequences. First, the propensity to use patents as an appropriability mechanism decreases. Second, such firms increase their investments in R&D. However, this change is not the reflection of an increase in incentives to invest in innovative activities but rather a reflection of efforts made to adapt to the institutional changes created by the shock. Evidence suggests that the lower ability to exclude using patents forces firms to shift the composition of their innovative activities, which explains the increase in R&D costs. The quantitative analysis shows that firms on the losing side do not lose incentives to innovate contrary to the arguments made by such firms in the qualitative evidence. Their arguments and positions against the changes are consistent with innovation being central in our knowledge-based economy for firms' competitiveness and the possibility that firms may have anticipated these increased costs.

4 CHAPTER 4 THE ROLE OF STAKEHOLDERS AND INFORMATION IN THE POLICY PROCESS

4.1 Introduction

Policy decisions are typically made in environments loaded with information, within which identifying and collecting the most relevant information is costly. In addition, policy decisions often require technical knowledge. Stakeholders can advance their private agendas by strategically providing information, taking advantage of the information asymmetry to influence decision-makers (among others: Brocas and Carrillo, 2007; Cyert and March, 1963; March, 1987, 1962). Stakeholder can use information to directly enlighten policymakers (Weiss, 1995, 1993, 1980), reframe policy problems (Daviter, 2015), and influence skeptical decision-makers (Andrews and Edwards, 2004; Eden, 1998; Ganz and Soule, 2019).

This chapter discusses the role of information and stakeholders in two phases of the policy process in the Supreme Court. The work by Baumgartner and Jones (2015) on the usefulness of different types of information at different phases of the policy process advances our understanding of how stakeholders and policymakers are likely to use information in policy settings other than the courts. In this view, entropic information, defined as information with high diversity in content supported by various sources, is useful at the agenda setting phase. On the other hand, expert information, providing deep knowledge from experts on narrow aspects of policy problems, is more useful at the policymaking phase to enable policymakers to make an informed decision when choosing a policy solution. Baumgartner and Jones (2015) point out a lack of empirical evidence in policy process theories in general and undertake steps to support their arguments using historical data from local, state, and federal budgets.

However, Baumgartner and Jones' study mostly uses data in a descriptive manner and is not able to overcome the traditional issues in isolating causal mechanisms (de Figueiredo and

Richter, 2014; Keim and Baysinger, 1988) that are faced by most studies examining the potential influence of stakeholders in policymaking, as detailed in Chapter 1.

In addition, existing policy process literature focuses on theory and empirical evidence almost exclusively concerning the executive and legislative branches of government, overlooking the judicial branch (Sabatier and Weible, 2014). Policy process studies on the role of information (e.g. Baumgartner and Jones, 2015; Daviter, 2015; Weiss, 1993) present the same gap.

In light of these gaps, this chapter makes three contributions. First, I extend the policy process theory proposed by Baumgartner and Jones (2015) to the judicial branch of government. To identify the relevance of the arguments made by Baumgartner and Jones (2015) to the judicial branch of government, I rely on the legal and political science literature on the Supreme Court (among many others: Corley, 2011; Gely and Spiller, 1989; Spriggs and Wahlbeck, 1997). I also build on the organization theory literature that provides insights on the role of information applicable to interactions between stakeholders and policymakers (among others: Brocas and Carrillo, 2007; Cyert and March, 1963; March, 1987, 1962). This extension notes the unique features of the context of court-made policy: the agenda setting phase is distinct from the policymaking phase, there is a restricted set of alternatives to consider in the policymaking phase and a need to be consistent with past decisions following the principle of "stare decisis" (as detailed in Chapter 2). I use these features to argue that the roles of entropic and expert information in each phase of the policy process are more clearly discernible for the judicial branch of government compared to other policy settings.

Second, I demonstrate that using the judicial branch of government as a novel empirical setting provides opportunities to present empirical evidence on the role of information and stakeholders. The policy process literature (Sabatier, 2007) as well as the literature on the use of information in policy (Baumgartner and Jones, 2015) struggles to propose testable theories

and empirical evidence. The aim of this study is to overcome traditional challenges and provide evidence on the role of stakeholders and different types of information on policymaking.

By studying patent-related policymaking at the US Supreme Court, I exploit a setting in which information is provided by stakeholders (litigants and amici) through a recorded procedure that results in observable interactions between stakeholders and policymakers (Justices). As detailed in Chapter 2, the judicial branch of government provides unique opportunities to conduct empirical studies with archival data on defined policy problems (legal cases focused on a specific question) and status quo (established laws and jurisprudence), stakeholder participation (parties and amici), the transfer of information (briefs and oral arguments), a clear distinction between the agenda setting (*certiorari* phase) and the policymaking phase (*merits* phase), as well as observable argumentations of the policymaker's decisions (final ruling in an *opinion*). For the agenda setting phase, I conduct a case study of the interactions between stakeholders and the Justices on all petitioning cases on a given topic in a time period that includes two cases that reached the agenda and resulted in policy changes. For the policymaking phase, I build a panel data set comprising all the patent-related Supreme Court cases over 2000-2015 that involve 1,155 unique stakeholders engaged 2,549 times in the form of parties or amici.

Third, I also aim to contribute to the legal literature. Legal scholars have long recognized the Supreme Court as a policymaker (Dahl, 1957) and examined various aspect of the *certiorari* phase (among others: Black and Boyd, 2012; Black and Owens, 2009; Caldeira and Wright, 1988) as well as the *merits* phase (among others: Corley, 2011; Johnson, 1997; Segal and Spaeth, 2002). Empirical evidence has shown that information provided by stakeholders influences the Court (Black and Boyd, 2012; Caldeira and Wright, 1988; Chien, 2010; Spriggs and Wahlbeck, 1997). To the best of my knowledge, however, this literature has not examined the role of different types of information. Empirical evidence on the effect of

information provided by stakeholders on the Supreme Court has been primarily obtained in previous research by using plagiarism software to examine the overall language of briefs and opinions (Chien, 2010; Collins et al., 2015; Corley, 2011; Spriggs and Wahlbeck, 1997). These studies do not make a distinction between the diversity and level of expertise of participating stakeholders and the arguments they make. Therefore, this study improves our understanding of legal policymaking by acknowledging the differential roles of unique types of information.

4.2 Theoretical Framework

> *"This 'information as diversity' is very different from information as expertise and each is applicable to different parts of the process of decision making." (Baumgartner and Jones, 2015, p. 47)*

Baumgartner and Jones (2015) distinguish two types of information used by policymakers: entropic information and expert information. The authors argue that each type of information is useful in a different phase of the policy process. Entropic information refers to a set of diverse arguments (content of the information provided) supported by diverse, non-redundant stakeholders. This type of information can help order a chaotic information environment by "operating in the problem space when trying to define and prioritize diverse signals that may indicate difficulties in the environment" (Baumgartner and Jones, 2015, p. 41). Entropic information helps policymakers set an agenda by considering the full picture in order to prioritize problems on which to focus and to define the boundaries of problems that are often complex (Baumgartner and Jones, 2015; Simon, 1973).

Expert information, on the other hand, is obtained from a specialized group of experts to elicit deeper knowledge on specific agenda items. This type of information is useful in the policymaking phase in which policymakers try to solve the problems that are on their agenda (Baumgartner and Jones, 2015). However, in practice, policy problems are often too complex to define before obtaining any expert information. This creates a "chicken and egg" situation for policymakers because the resources to collect expert information will be invested only once

a problem is identified as an agenda item that requires such effort. Therefore, based on their observation of the elected branches of government, Baumgartner and Jones (2015) point out that policymakers often conduct both agenda setting and policymaking simultaneously.

The first key difference in the judicial branch of government is the *certiorari* phase followed by the *merits* phase at the Supreme Court. This creates a clearer distinction between agenda setting and policymaking compared to other settings. As a result, the courts also provide an opportunity to distinguish between the way in which information is used and the way in which stakeholders behave in the two phases.

A second key difference is that the set of problems and policy solutions to choose from in the policymaking phase in the judicial branch is constrained in comparison to the elected branches of government. The Supreme Court selects problems from a pool of cases tried in lower courts, and decisions made to solve such problems requires the consideration of fewer alternative solutions compared to those made by the executive and legislative branches. A solution adopted by the Supreme Court among this restricted pool of solutions must be supported to be perceived as legitimate. As a result, a key difference in terms of the policymaking phase is that Supreme Court Justices may be more interested in supporting a policy decision with multiple arguments than deeply understanding narrow aspects of the issue. Consequently, I argue that the diversity of arguments can have a role in the policymaking phase in the judicial branch. Its potential role beyond the agenda setting phase is not discussed for the elected branches of government (Baumgartner and Jones, 2015). Discussions and empirical results based on the two discernable phases in the court setting provide a starting point to engage with the potential role of entropic information in the policymaking phase in general policy settings.

Third, policymaking in the Supreme Court is made under the weight of past decisions that establish an institutional environment in which shifts in perceptions are difficult to induce.

In the Supreme Court, decisions must account for the existing law and legal precedents. Any departure from precedent requires justification to grant legitimacy to the newly adopted jurisprudence. However, decisions in the agenda setting phase do not need to be officially justified, whereas arguments supporting decisions in the policymaking phase must be made public. Therefore, legal arguments are likely to be used to discuss consistency with past decisions and expertise is likely to be needed to justify a departure. As a result, expert information provided by stakeholders is likely to influence the policymaking phase, consistent with predictions based on the elected branches of government (Baumgartner and Jones, 2015).

In this organizational structure, Justices receive information from stakeholders' arguments and behavioral "cues" that potentially influence their decision to review a case and to select a solution among alternatives. Political scientists have examined the Court's use of cues to swiftly determine cases that may be discarded from the ones deserving more scrutiny, and whether stakeholders strategically manipulate such cues (e.g., Caldeira and Wright, 1988; Tanenhaus et al., 1963; Ulmer, 1984, among others). Supreme Court Justices make these decisions within the constraints, incentives, and limitations they face as policymakers (presented in Chapter 2). In this context, parties and amici as stakeholders are self-interested actors that have incentives to strategically supply policymakers with information. Therefore, in this section, I elaborate on the role of stakeholders and information in the two phases of the policy process in the Supreme Court and propose a set of hypotheses to guide data analysis in the empirical part of this chapter.

4.2.1 Entropy

> *"To distinguish it from expertise, we term this form of information as entropic information. A receiver has more information when messages on a variety of topics are produced by multiple nonredundant sources." (Baumgartner and Jones, 2015, p. 47)*

The notion of entropic information as defined by Baumgartner and Jones (2015) involves two dimensions of diversity: diversity of the arguments and of the stakeholders providing the

arguments. Baumgartner and Jones (2015) propose to operationalize this construct by using measures based on the Herfindahl-Hirschman index (Herfindahl, 1950; Hirschman, 1945) or Shannon's index (Shannon and Weaver, 1949), essentially accounting for the dispersion of arguments across various sources.

To examine how this concept is likely to impact the two phases of the policy process in the courts, I distinguish the two dimensions of diversity involved and discuss the underlying reasons why each may or may not matter for the Supreme Court as a policymaker. I discuss whether entropic information is likely to influence the agenda setting phase (Baumgartner and Jones, 2015) in the judicial branch of government and whether we can expect diversity to matter in the policymaking phase as well.

4.2.1.1 Diversity of stakeholders

Diversity of sources of information is desirable because policy issues are complex. Therefore, no single stakeholder is expected to provide an accurate and complete view of problems (Baumgartner and Jones, 2015). In the judicial branch of government, this may be less of a concern because more time and resources are spent in the policy process and it is an adversary system (Larsen, 2012). In an adversary system, "if one party presents unreliable or flawed evidence to support his factual claim, then we can count on the other party to point this out" (Larsen, 2012, p. 1257). This tension increases the quality of the information for the policymaker and makes withholding relevant information more difficult for stakeholders.

The diversity of stakeholders is also likely to be important for other reasons in the Supreme Court. A conceivable objective of the Court in a democratic system like the United States is to make policy decisions following democratic principles (Dahl, 1957). The Justices can consider the number of stakeholders on each side of a case as a proxy for saliency – the economic, political, and social importance of the case (Caldeira and Wright, 1988). Participation itself is an indicator of how many actors find a problem important enough to

dedicate resources to participate (Caldeira and Wright, 1990; Songer and Kuersten, 1995). According to Black and Boyd (2012), if saliency is a key indicator for Supreme Court Justices, the probability of a case being reviewed should uniformly increase with the number of amici because Justices want to tackle "important and far-reaching" cases. Empirical evidence in the Supreme Court shows that the presence of amici increases a case's likelihood of being granted *certiorari*, but does not seem to affect the *merits* phase (Caldeira and Wright, 1988). This finding supports the view that stakeholder diversity matters for the agenda setting phase consistent with the argument made by Baumgartner and Jones (2015). Baumgartner and Jones (2015) do not discuss the role of entropic information for the policymaking phase, implicitly suggesting either that entropic information is likely to have no effect or may have a negligible effect. This view is consistent with the lack of an effect found in the *merits* phase.

H1: Diversity of stakeholders positively influences agenda setting in the judicial branch of government

4.2.1.2 Diversity of arguments

According to Baumgartner and Jones (2015), a diversity of arguments is desirable because it can provide the most exhaustive view of the world when selecting problems to put on a policymaking agenda. In addition, a broad range of views are needed to understand policy problems because they are often complex (or "wicked") (Rittel and Webber, 1973) and not well-defined (Simon, 1973). The Supreme Court tackles a broad range of topics and complex interdisciplinary issues (see the list in Section 2.2 of Chapter 2). Therefore, intuitively, the argument made by Baumgartner and Jones (2015) could be applicable to the agenda setting phase of the Supreme Court.

However, the legal literature suggests otherwise. To the best of my knowledge, the legal literature has paid little attention to the diversity of arguments made in court for both the agenda setting and policymaking phase. A key point that studies on the agenda setting phase of the

Supreme Court consistently point out is that the Court receives a heavy load of petitions and relies on "cues" to make decisions speedily (Baum, 1993; Black and Boyd, 2012; Black and Owens, 2009; Songer, 1979; Teger and Kosinski, 1980). This may be why studies have taken more interest in the presence of advocates filing amicus briefs as a potentially influential factor rather than the content itself for the *certiorari* phase. Shapiro (1984, p. 24) even recommends that advocates "never file an amicus brief opposing *certiorari*" because it "merely highlights the importance of the case and thus conveys an impression exactly the opposite of the impression the amicus organization wishes to convey." Therefore, the diversity of the content of briefs is not expected to be influential in the *certiorari* phase of the Supreme Court. As a result, the effect in the Court is expected to be the opposite of the effect that Baumgartner and Jones (2015) predict in the agenda setting phase based on other policy settings.

On the other hand, previous studies have found that briefs in the *merits* phase provide information that helps Justices anticipate the impact of each alternative policy solution (Spriggs, 1996; Spriggs and Wahlbeck, 1997). While participation itself does not matter directly (Caldeira and Wright, 1988), the information brought by participants matters. Empirical evidence from several studies supports the view that the content of parties' briefs and amicus briefs influence the Court in the policymaking phase (Collins, 2004; Corley, 2011; Spriggs and Wahlbeck, 1997). To the best of my knowledge, no studies in the *merits* phase have examined the effect of the diversity of arguments provided. I argue that the diversity of arguments is likely to have a positive impact on the policymaking phase in the judicial branch of government. The effect of diverse information in the policymaking phase has not been discussed by Baumgartner and Jones (2015) on other policy settings. However, as mentioned previously, this explicitly suggests that no effect or a negligible one was expected.

In the elected branches of government and most policy settings considered by the policy process literature, the policymaking phase consists of selecting the best possible policy solution

from a multitude of potential solutions. Therefore, as pointed out by Baumgartner and Jones (2015), a deep understanding of the problem based on expert information is more desirable than a diverse set of information. Conversely, the structure of the policymaking phase in the Court consists of choosing between a small set of alternatives. While the Justices can introduce some nuance in their ruling, the Supreme Court ultimately rules in favor of the petitioner(s) or the respondent(s). Therefore, the objective of the court is to decide which side wins and how by choosing between a restricted set of alternatives, and to ensure that the decision will be perceived as legitimate (Dahl, 1957; Murphy, 1964).

In particular, the Supreme Court's actions are undertaken in tension between legal considerations and policy considerations. Changes in the socioeconomic environment may justify a departure from the status quo. The Justices need to justify their decisions to make or reject such a departure in consistency with the body of law (Dahl, 1957; Supreme Court of the United States, 2017). In addition, as detailed in section 2.4.2 of Chapter 2, the Justices aim to advance individual agendas based on their own ideology and policy preferences (Dahl, 1957; Sheehan et al., 1992). Therefore, Justices can be expected to value the opportunity to support decisions with both legal arguments and policy arguments.

Legitimate decisions can be made by supporting the choice with the most compelling arguments. As a result, there is value for the Justices in obtaining a diverse set of arguments to use in support of the final ruling. One of the dimensions of entropic information, diversity of arguments, may have a role in the policymaking phase of the judicial branch of government. The same argument is not applicable to the agenda setting phase. In addition to having finite resources to focus on the content of briefs due to high loads of petitions, the Justices are not required to justify rejections in the *certiorari* phase.

H2a: Diversity of arguments does not influence agenda setting in the judicial branch of government

H2b: The position supported by a higher diversity of arguments is likely to win at the policymaking phase in the judicial branch of government

4.2.2 Expertise

Baumgartner and Jones (2015, p. 46) argue that in the policymaking phase, "in determining what solution fits a given problem, we rely heavily on experts (or at least we ought to)." In court, these experts can participate as stakeholders. In addition, both expert stakeholders and those who are not experts can cite publications produced by experts to support their arguments. Expert information, also referred to as technical knowledge or scientific knowledge in the literature, matters in the policy process because it helps policymakers design better policies and successfully solve problems (Baumgartner and Jones, 2015; Bendor and Meirowitz, 2004; Callander, 2008; Weiss, 1980).

A body of work in the policy learning literature by Carol Weiss examines how knowledge can help policymakers make better decisions (Weiss, 1995, 1980). Weiss introduces the concept of knowledge creeping (1980); the use of information may not be discernible immediately and information is not necessarily directly used. Indirect influence can occur when consistent evidence accumulates to shape the policymaker's vision of the problems and the alternative solutions over time (Weiss, 1993, 1980). This is a long-term process of "enlightenment" that can take "five or ten years or more before decision-makers respond" and transforms their policy decisions (Weiss, 1993). Sabatier (1988) builds on this view to argue that stakeholders are central to this learning process. While some types of belief are permanent ("core beliefs"), certain types of beliefs ("secondary beliefs") can change when evidence is received. This is consistent with the argument made by Baumgartner and Jones (2015). However, the reason for the influence of expertise is not limited to its potential "enlightening" function.

In the political science literature, Callander (2008) argues that expertise is not simply a piece of information that is transferred from an expert to a layperson that turns the layperson into an expert. Depending on the complexity of the issue, the lay person will acquire a certain level of expertise. Despite this persisting asymmetry of information, expert information can be influential on policy decisions because of the legitimacy that it conveys. Expertise has an intrinsic authority due to the assumption that it is based on an objective, rational, and rigorous process of production and controlled by the expert and scientific community that produced it (Nelkin, 1975). As a result, supporting an argument with science can "de-politicize public issues" (Nelkin, 1975). This perceived legitimacy may be borne by experts as individuals/organizations, by whomever makes arguments supported by information produced by experts, or both.

Literature that examines the policy processes in the elected branches of government finds that expertise is sought out by policymakers to make decisions that are perceived as legitimate (Boswell, 2008; Eden, 1998; Ganz and Soule, 2019). Ganz and Soule (2019) point out that, according to the social movement literature, stakeholders such as environmental movement organizations use scientific expertise to legitimate policy claims, especially to influence skeptical decision makers. In the policymaking phase, Jasanoff (1990) remarks that even during periods of "bitter ideological confrontations," scientific advisory committees are perceived as indispensable to help policymakers make decisions on technical problems, and the work these committees conduct remains "curiously sheltered" in the eyes of the public in American politics. Also, Ganz and Soule (2019) find that environmental movement organizations are influential in the policymaking phase in Congress due to their "scientific expertise and perceived legitimacy."

The Supreme Court has an interdependent relationship with the elected branches of government. This is exemplified by the appointment of new Justices. Another example is that

the number of seats on the Supreme Court bench and the jurisdiction of the Court can in theory be modified by the executive and the legislative branches, although elected branches rarely exercise their power on the Supreme Court in this way (as detailed in Chapter 2). Elected branches of government are likely to be sensitive to the legitimacy that their constituency perceives regarding the Supreme Court's decisions when interacting with the Court. As a result, the Supreme Court's power is particularly dependent on legitimacy (Baum, 1977; Epstein et al., 1989; Gely and Spiller, 1989; McCubbins et al., 2005, 1994b; Spiller and Gely, 1992; Spiller and Tiller, 1997). Therefore, expert information is likely to influence the Supreme Court's decisions in both phases of the policy process. This is likely to be especially true in cases involving highly technical issues, such as environmental protection or intellectual property, which typically involve significant processing costs in addition to search costs. On the other hand, expert information focused on legal matters is likely to involve lower search and processing costs given the legal expertise of Justices and their clerks.

In addition, there is an asymmetry of information between the Supreme Court and stakeholders who are experts for those technical issues. In comparison, this may not be the case for other topics, such as First Amendment rights issues. When there is asymmetry of information, the organizational theory literature has established that information can be used as a source of power (Brocas and Carrillo, 2007; Cyert and March, 1963; March, 1987, 1962; Nelkin, 1975). Therefore, consistently with Baumgartner and Jones' (2015) argument, expertise can be expected to influence the policymaking phase. On the other hand, the existence of an influence of expertise on the agenda setting phase depends on which mechanism is involved. If the Supreme Court is being "enlightened" by expertise, the impact is the same in the agenda setting phase. However, if the Supreme Court uses expertise as a way to legitimize their decision, expertise is likely to matter less in the agenda setting phase because there is no obligation for the Court to justify its decision and decisions have lower visibility to the public

due to the heavy load of petitions. "Enlightenment" occurs when the content of the information convinces the Court, regardless of who supplied the information. On the other hand, legitimacy in using expertise can also be obtained by using experts' advice regardless of the content. Therefore, I test two rival hypotheses:

> *H3a (enlightenment hypothesis – expert information regardless of supplier): Stakeholders win by enlightening policymakers with expert information at both the agenda setting phase and the policymaking phase in the judicial branch of government*
>
> *H3b (legitimation hypothesis – expertise regardless of content): Stakeholders win by helping policymakers legitimate their decisions at the policymaking phase in the judicial branch of government*

4.2.3 Indirect effects: Strategic supply of information

The Justices' actions and goals are not likely to be limited to adopting the best policies by relying on the most exhaustive view of the world possible. As detailed in Chapter 2, they have policy preferences and cognitive limitations that influence how they make decisions and filter the information obtained from stakeholders. As mentioned in the previous section, in cases with an asymmetry of information, stakeholders have institutional power to influence policymakers (Cyert and March, 1963; March, 1987, 1962) and can be expected to strategically supply them with information. This section discusses additional mechanisms that may alter the extent to which entropic information and expertise influence the policy process in the Supreme Court.

4.2.3.1 New information to "shift" attention

Daviter (2015, p. 494) points out that the view that information is used to "inform the search for suitable policy solutions" in the policy process is narrow and simplistic. Information is not simply used to solve policy problems; it can also frame them (Jones, 1994). Actors with private information can influence others by making some amount of such information available (Brocas and Carrillo, 2007). The information disclosed can be new "enlightening" information or can

shed light on information that was already available but had received little attention (Baumgartner and Jones, 2015).

New information can be used in a strategic way to create "knowledge shifts" that explain policy change. This expression is used in opposition to "knowledge creep," which leads to incremental changes. Scott Ganz reviews the literature on the role of experts in policymaking (Ganz, 2018; Ganz and Soule, 2019) and points out that from the 1980s, the academic literature has examined how information asymmetry and the misalignment in goals between an uninformed principal (e.g. policymakers) and expert stakeholders creates situations of agency in the elected branches of government (Crawford and Sobeli, 1982; Ganz, 2018; Gilligan et al., 1987). In parallel, the literature on behavioral theory finds that in situations of conflicts of interest within an organization, coalitions of actors use information for institutional power (Cyert and March, 1963; March, 1987, 1962). As a result, stakeholders participating in Supreme Court cases also potentially strategically use their knowledge to influence the framing of problems.

Rare events such as major policy changes can be triggered by knowledge that fundamentally shifts the perceptions of the status quo (Baumgartner, 2013; Hall, 1993). Knowledge can create dramatic changes despite the weight of past decisions. This institutional inertia, also referred to as "the power of status quo," constrains policy change to a minimal level most of the time (Hall, 1993). The degree to which a status quo has been discredited will affect the perceived need to look for alternatives. The perception of such a need is also referred to as a change in policy image in the punctuated equilibrium theory (Baumgartner et al., 2014; True et al., 1999) and is likely to be triggered by knowledge. Policy change through this mechanism involves the co-existence of long periods of incremental policy change punctuated by occasional major changes. Empirical evidence of such major policy changes have been examined using the US federal budget (Baumgartner, 2013) and data from other countries'

executive and legislative branches (Green-Pedersen and Wilkerson, 2006; Penner et al., 2006; Soroka, 2002). Evidence is descriptive rather than causal because of the identification and measurement challenges detailed previously (de Figueiredo and Richter, 2014; Pittman, 1977; Zardkoohi, 1985).

In the policy process literature, scholars who have considered information as useful to inform better policy decisions have also acknowledged and examined the "multifaceted" role of knowledge (Weiss, 1977) and the use of technical information to confirm pre-existing beliefs (Sabatier, 1978). However, this strategic behavior has been given little importance in the "enlightenment" view or in policy learning theories. Recent studies (Baumgartner and Jones, 2015; Daviter, 2015) and recent political events in the United States, such as the growing concern for "fake news," have shown that significantly more weight should be put on the strategic use of knowledge when explaining politics and policymaking.

4.2.3.2 Bias towards stakeholders

The legal and political science literature has widely accepted that Supreme Court Justices' ideologies and personal preferences that guide their decisions cannot be ignored (Baum, 1977; Dahl, 1957; Martin and Quinn, 2007; Murphy, 1964).

Many studies have examined the attitude of Justices towards different types of stakeholders (Black and Boyd, 2012; Segal and Spaeth, 2002; Sheehan et al., 1992). In the policymaking phase, several studies do not find empirical evidence that stakeholders' status affects the final ruling (Collins, 2004; Paul M. Collins, 2007; Sheehan et al., 1992). In the agenda setting phase, multiple studies have found significant results regarding the influence of the status of stakeholders (among others: Black and Boyd, 2012; Black and Owens, 2009; Mcguire and Caldeira, 1993).

Recent work by Black and Boyd (2012) builds on existing insights and finds evidence that the status of stakeholders does not explain the Supreme Court's decision by itself. Using

empirical data in the *certiorari* phase, Black and Boyd (2012) find that the status of litigants and interest groups as amici matters in interaction with Justices' political orientations. Liberal Justices tend to favor "underdogs" (operationalized as essentially all actors that are not corporate or governmental litigants) over "upperdogs," while conservative Justices behave in the opposite direction. In addition, with liberal Justices, "underdogs" obtain some benefit from having interests groups as advocates whereas "upperdogs" do not (Black and Boyd, 2012). These results show a more nuanced effect in the judicial branch of government compared to the result for the elected branches of government in which Galanter (1974) finds that the "haves" simply obtain better outcomes than the "have nots" (which respectively refer to "underdogs" and "upperdogs"). In addition, this shows that the Supreme Court Justices' policy preferences act as filters of the information obtained from stakeholders and observations of stakeholders' behavior.

These findings suggest that obtaining an exhaustive view of the world may be secondary to the Justices allocating attention based on their preferences. Both stakeholder type and the stakeholder's resources are likely to be influential factors. However, to the best of my knowledge, all the empirical evidence provided by legal scholars use cases in tackling question with some extent of partisan orientation that is likely to drive the Justices' vote. Although the empirical part of this chapter uses a setting with a non-partisan issue,[49] I control for stakeholder types, and particularly for indications that they are "haves."

4.2.3.3 Information to feed confirmation bias

Decision-making in policy is vulnerable to confirmation biases. A policymaker can voluntarily search for information that supports and legitimizes a pre-existing belief. Such behavior can also be less deliberate. Humans have a tendency to "draw one-sided evidence from ambiguous

[49] As detailed in section 4.3.1: Supreme Court Justices were unanimous in two-thirds of the cases decided over the period 2000-2015 and among the remaining third, none of the dissents followed party lines.

evidence" and this bias is related to personal beliefs (Lewis, 2008). Kahneman and Egan (2011) point out that as people look for evidence to make a decision, their minds work like those of lawyers trying to find evidence that will exonerate their client; people look for information to support their preconceived notions. As a result, even if policymakers are making decisions in good faith, they could be using information with selection bias due to their pre-existing preferences (Baumgartner and Jones, 2015).

Justices of the Supreme Court are trained as lawyers and make decisions based on their policy preferences (Black and Owens, 2009; Martin and Quinn, 2007; Segal and Spaeth, 2002). To make these decisions and fulfill their policy goals, they need information regarding the potential impact of alternatives, and this information partly comes from the stakeholders (party and amici) (Caldeira and Wright, 1990; Spriggs and Wahlbeck, 1997). As previously mentioned, a situation of asymmetry between the better-informed stakeholder and the policymaker creates a situation in which the stakeholder communicates just enough information to induce the policymaker "to respond to it and holding back enough so that his response is as favorable as possible" (Crawford and Sobeli, 1982). Therefore, assuming that stakeholders are self-interested entities, if they have knowledge about the Justices' preferences, they are likely to filter the information they provide based on their anticipated reaction.

The stakeholders' arguments are likely to reflect the arguments that Justices have previously signaled that they find legitimate. Using such information, the stakeholders can frame a problem to influence Justices more efficiently. In this case, stakeholders who have the resources to be repeat participants are likely to have an advantage by learning about Justices' preferences.

4.3 Empirical Setting

4.3.1 Patent policymaking in the Supreme Court

To empirically examine the role of different types of information and stakeholders in the two phases of the policy process in the judicial branch of government, I use the setting of patent policymaking in the Supreme Court over the period 2000-2015. Key advantages of this as an empirical setting are the following (discussed in further detail in section 2.5.3 in Chapter 2).

First, patents are a relatively non-partisan policy topic (Sag et al., 2009). Therefore, outcomes are not predicted by partisanship and information can potentially influence policy decisions. Second, understanding patent-related issues requires expertise related to technology and the socio-economic incentives behind patent strategies. Therefore, there is an asymmetry of information between stakeholders and policymakers, and as a result, policymakers are likely to need expertise. Third, the Supreme Court has been a central policymaker over the period of the study (Holbrook, 2013).

The setting also presents advantages in terms of identification and measurement. Unlike other policy settings, the exchange of information between stakeholders and policymakers, including the arguments made to advocate for a stakeholder's position (briefs) or justify a policy decision (opinions) are available in archival data. There is variation in the participation behavior and the information exchange, as opposed to lobbying in other branches of the government. Policy problems are clearly defined and the two phases of the policy process are distinct. Supreme Court Justices are appointed for life and no lobbying is permitted in court. Therefore, concerns for financial incentives and constituency-building are very limited.

These features solve for the three key traditional challenges faced by studies in isolating causal mechanisms between the behavior of stakeholders in the policy process and policy outcomes (de Figueiredo and Richter, 2014; Pittman, 1977; Zardkoohi, 1985). Nevertheless, this setting has its limitations. First, entities who have a stake in the policy issue may not be

participants. Free-riding behavior is not observable and there is a concern of selection bias. However, the relatively low cost of filing a brief, lower than USD 20,000 (Caldeira and Wright, 1988; Chien, 2010) in comparison with the resources required to lobby, suggest that the barrier for participating is low. In addition, the cost can be shared with other stakeholders by submitting a brief as a group, which mitigates the concern of selection bias.

Among all cases handled by the Supreme Court, patent cases represent less than 2% (see Chapter 2 for detail) and all cases cannot be generalized as non-partisan. Some topics, such as abortion or civil rights, may allow little external influence and the main predictors of the decision may be the number of Justices that have strong political preferences on the topic. Therefore, results will not be applicable to the same extent to Supreme Court cases in other topics. Nevertheless, this study provides information about how Justices and stakeholders are likely to behave and influence each other within the latitude allowed by topics and the strength of preferences of the Justices on the bench. These results are more clearly generalizable to cases in which the question is apolitical and the Justices are non-expert.

4.3.2 Key variables of interest

4.3.2.1 Outcome

For the agenda setting phase, the key outcome is whether a case was placed on the agenda of the policymaker. In this study, this outcome is measured by the decision of the Supreme Court as a whole to grant or deny review in each petition. A limitation of this study is that I am unable to observe the votes of each Justice or their interaction with clerks when information is processed.

Regarding the policymaking phase, there are two key outcomes. The first is being on the winning side in the final ruling on a case. Second, I measure how many arguments made by the Supreme Court in the opinion overlap with arguments made in briefs submitted by stakeholders.

4.3.2.2 Explanatory variables

One of the novel contributions of this study is its systematic analysis of arguments using cited cases as a proxy for the arguments. By scraping the briefs for regular patterns, I am able to associate all stakeholders with the legal precedents and the documents produced by experts that they cited. Therefore, I can map the arguments made by stakeholders on the winning and losing sides across multiple cases. The key independent variables are entropic information, related dimensions of diversity, and expert information.

Baumgartner and Jones (2015) propose to measure entropic information with an entropy index that involves using a Markov process to provide a probabilistic representation of how much information is produced by each source (Shannon and Weaver, 1949). In this study, I distinguish the two aspects of diversity involved in the notion of entropic information defined by Baumgartner and Jones (2015).

The first aspect is the *diversity of stakeholders* providing information based on a count of distinct stakeholders participating.

As an alternative measure, I use the count of distinct types of stakeholders. Justices can infer how different segments of the population are likely to be affected based on the type of stakeholders participating in a case. Stakeholders that have the resources to petition the court and submit amicus briefs can be expected to have an advantage. The diversity of types of stakeholders represented may be important given that legitimacy is central for the Supreme Court (Murphy, 1964). Therefore, minorities' interests should have as much weight as the participants endowed with large resources and power (as detailed in Chapter 2). Therefore, I conduct robustness checks on the count of distinct types of stakeholders. For the types of stakeholders, I use a slightly modified version of the classification proposed by Collins (2007, 2004) that includes nine categories (Table 10). Black and Boyd (2012) choose this scale over others to examine the role of litigant status on *certiorari* decisions. They point out that this

scale's key improvement over previous scales (e.g. Mcguire, 1995; Sheehan et al., 1992) is that it accounts for interest groups and governmental actors. Individuals involved in cases are inventors, lawyers, or academics. Among businesses, I distinguish big businesses from businesses of other sizes: big businesses are large national or international corporations "that presumably have greater litigation and financial resources than smaller 'mom and pop' businesses" (Farole, 1999). For firms, I use computerized matching with information from Compustat and from the website referenceUSA.com. The remaining missing information is assigned manually based on company website information and the description of amici mandatory in all amicus briefs. I use the definition of small and medium enterprises provided by the Small Business Administration (SBA) of 500 employees and USD7 million in revenue.[50] Similarly, among interest groups, I distinguish associations that represent the interests of big businesses from other associations. I use this categorization as an alternative measure that captures the diversity of types of stakeholders on a scale of 1 to 9.

Second, I examine the effect of the *diversity of arguments* that were made using a proxy based on the citations made in briefs and opinions. Two types of citations are used as a proxy for arguments. Legal arguments are proxied by all references to legal precedents made by District Courts, the CAFC, or the Supreme Court. Expert arguments are all references citing documents published by experts, which include academic publications and reports by interest groups (non-profits or non-governmental organizations, excluding associations of businesses).[51] Given that this variable concerns diversity, I pool the two types and use the total count of arguments as the measure.

[50] This criterion is only used in a handful of ambiguous cases. Almost all of the businesses are either large corporations with a national or international market or very small firms founded by a patent-holding inventor.

[51] The list excludes governmental reports, public and private entities' reports, news articles, congressional hearings, briefs filed in prior legal cases, and statistics such as company financials or USPTO statistics. References to "rules" are also excluded (US Code, Federal regulation, Acts adopted by Congress, executive orders, manual for USPTO examiners, etc.).

Expert information is examined in two ways. The first measure is the participation of experts. Experts include stakeholders identified as academics (individual scholars or universities) or interest groups (non-profits or non-governmental organizations, excluding associations of businesses). While some governmental organizations have high levels of expertise (e.g. USPTO, ITC), I do not consider them as experts to use a conservative measure of expert information restricted to policy-relevant information excluding legal and procedural concerns (e.g. manuals for drug evaluation by the FDA, manuals of patent examining procedure by the USPTO). An improved empirical contribution can be made by examining expertise with more precision by manually distinguishing between different kinds of publications produced by a given entity. This remains out of the scope of this thesis. The second measure involves the policy arguments based on expertise (henceforth simply referred to as "policy arguments"), proxied by citations of documents produced by experts: academics or interest groups (non-profit organizations, excluding associations of firms).

A key aspect to control for in both phases of the policy process is the difference in resources available to stakeholders to enhance their ability to influence policymakers. I consider resources as a latent variable for which the observable aspect is lobbying in the other branches of government. I use the amount of money spent in lobbying by stakeholders during the three years preceding a decision as a measure. As a robustness check, I use an alternative measure based on the cumulative count of lobbying actions undertaken. The operationalization based on lobbying the elected branches of government provides the advantage of capturing the potential influence of the other branches of government on the judicial branch. However, the lobbying data is left truncated, and values for the years 2000, 2001, and 2002 are assigned based on those of 2003.

Because of this limitation, I conduct robustness checks using an alternative measure. The legal literature refers to "haves" and the "have nots"; in this setting, the "haves" can be operationalized as stakeholders that are big businesses, associations of big businesses, and governmental organizations. This is a pragmatic solution even though it is "weakened at times by arbitrariness and overgeneralization" (Wheeler et al., 1987).

Table 10. Stakeholder categories

Stakeholder (litigant or amici) status	Detail and example	Expert	Haves
Individual academic	Law, business, economics, and intellectual property professors	Yes	No
Individual other	Inventor, lawyer	No	No
Academic organizations	Universities or university-related	Yes	No
Businesses	Presidio Components Inc., local manufacturer of ceramic capacitors in San Diego, less than 200 employees	No	No
Associations of businesses	National association of chain drug stores, National small business association	No	No
Big businesses	Apple, Monsanto, General Motors	No	Yes
Associations of big businesses	CTIA – the Wireless Association, the Pharmaceutical Research and Manufacturers of America	No	Yes
Interest groups	Public Knowledge, the Public Patent Foundation	Yes	Yes
Governmental organization	The United States, the US Department of Justice, the International Trade Commission	No	Yes
Other	Mostly individuals who are lawyers or inventors	No	No

4.4 Case Study of Agenda Setting

This section relies on the case study of a policy topic for which litigants of a set of patent-related cases at the CAFC have petitioned the Supreme Court. I isolate a list of federal-level

patent cases that focused on the same aspect of patents, used as a proxy of a policy topic to test the effect of the diversity of stakeholders (H1) and the influence of expert information (H3a and H3b) in the agenda setting phase. Additionally, I provide information about the use of expert information to examine the implicit intuition of Baumgartner and Jones (2015) that expert information does not matter in the agenda setting phase. To provide empirical evidence, I examine the difference 1) between cases that petitioned the court compared to those that did not; and 2) between cases that have been granted a *certiorari* and those that were denied a review.

An additional objective of this section is to provide an empirical understanding of the kinds of patent-related cases that are on the agenda of the Supreme Court. This provides information regarding the selection bias that affects the policymaking phase examined in the following section, which uses a sample of cases that were granted review by the Supreme Court.

4.4.1 Data

I obtain court documents from Westlaw that includes all patent infringement cases (section "1862 Injunctions" in the West Key number System in Westlaw) appealed at the CAFC, in which the question treated by the court concerned the conditions under which an injunction should be granted, restricting the data set to 37 cases using the keyword "injunction" over the period 2000-2012. The period of study starts in 2000 since the US Supreme Court became a central policymaking actor from the 2000s (Holbrook, 2013). Ideally, the period would extend as much as possible. To limit data collection costs, I examine a symmetrical window of 6 years before and after the most important ruling on this policy topic, which is the eBay v. MercExchange case of 2006 (Seaman, 2015).

I exclude one case in which the question concerns whether a subject matter is patentable or not (Patent Act section 101). The final sample includes 36 cases (listed in appendix H) for

which the District Court decision was appealed at the CAFC over 2000-2012. Among those cases, 14 petitioned the Supreme Court and 2 of the petitions were granted.

The two cases that were granted a review on the Supreme Court's agenda were the eBay v. MercExchange case of 2006 (547 U.S. 388, henceforth referred to as the "eBay case") and the Microsoft Corp. v. i4i Limited Partnership of 2010 (564 U.S. 91, henceforth referred to as the "Microsoft case").

I argue that both cases led to decisions that can be considered as patent policy, in which the status quo was changed in the eBay case and strengthened in the Microsoft case. I examine the number of articles that reference these cases in the "Business & Industry News" section of LexisNexis from the year following each of the two decisions until now. For the eBay case, 15 articles were written in 2007 and the number of articles per year consistently increased to reach 35 in 2018. The eBay case is referred to by some legal scholars as "one of the most important patent law rulings of the past decade" (Seaman, 2015). In 2011, 94 articles were written about the Microsoft case. This number then decreased overall with some variation between 3 and 12 articles per year until 2018. In comparison, among the 14 cases that petitioned the Supreme Court, the number of articles between the year following the decision by the CAFC and 2018, the cases were 21 and 9 for two of the cases over the entire period, and all others were mentioned between 0 and 5 times. Within this policy topic, the two cases reviewed by the Supreme Court resulted in the adoption of a policy that was noticed by industry.

For the 14 cases that petitioned the Supreme Court, I collect parties' briefs and amicus briefs, a total of 68 documents. By scraping regular patterns corresponding to legal precedent citations and citations of publications produced by experts using R, I collect information about the legal arguments and policy arguments made by stakeholders on both sides of the 14 cases. As a frame of reference, in the final opinions for the two cases reviewed, the Supreme Court made 12 legal arguments and no policy argument in the eBay case and 43 legal arguments and

two policy arguments in the Microsoft case. For all cases, including the 22 cases that did not petition the Supreme Court, I use company websites to collect information about the status of petitioner(s) and respondent(s).

4.4.2 Approach

The empirical analysis of the role of entropic information and expert information in the agenda setting phase is based on a case study. Among a group of legal cases that appealed at the CAFC within the same policy topic, I examine which cases petitioned the Supreme Court and which cases were granted *certiorari*.

The unit of analysis is a CAFC case. In addition to being a case study, the number of cases in the data set does not allow a proper statistical analysis. Thus, this empirical examination of the agenda setting phase cannot yield strong causal claims. Nevertheless, the key variables of interest presented in section 4.3.2 guide the analysis. I rely on descriptive evidence as indicators of potential causal effects to discuss the role of stakeholders and information in the US Supreme Court's agenda setting. The objective is to provide an in-depth understanding of one particular case (a policy topic) for future studies to extend the examination to multiple groups of cases to make conclusions based on more developed quantitative analyses.

In examining the effect of stakeholder participation and arguments in court on agenda setting, several alternative explanations have to be considered based on the literature.

Conflict is identified as an important predictor of grants of *certiorari* in Rule 10 (Supreme Court of the United States, 2017) and legal scholars have shown empirical evidence of its effect on agenda setting in the Supreme Court (Ulmer, 1984). This is measured as a dummy variable that captures whether the CAFC reversed the decision of the District Court specifically on the question(s) in the petition of the Supreme Court.

Public saliency of the topic. In the judicial branch of government, like the two other branches, Justices are not isolated from the world and Larsen (2012) finds that they "reach beyond the four corners of the parties' briefing when they think the parties have not done enough." Today, information is crowding out our attention with the Internet and Larsen (2012) finds that it is more and more commonly used by the Justices as a way to gather facts. Over this period of study, a growing concern regarding the use of injunctions in patent infringement litigation has created a shift in attitude from the view of patent holders as entities defending their property to doubting their good faith. A narrative developed regarding "patent trolls" identified as non-practicing entities that do not produce social welfare by having invested in the R&D of the patented technology nor commercialized it. They are viewed as entities that sue other actors in the market to extract settlement money from legitimate actors, who are under "holdup" and unable to produce and commercialize technologies. I examine the number of Google searches of the keywords representing the key arguments related to this concern: "patent troll" in all categories and "holdup" restricted to the business & industrial category. The objective is to control for influence unrelated to briefs filed during the legal procedure.

4.4.3 Findings

4.4.3.1 Among CAFC cases: Petition v. no petition

Before examining the difference between cases in which *certiorari* was granted and those that were denied *certiorari*, I examine the differences between cases that petitioned the Supreme Court and those that did not, among all cases reviewed at the CAFC.

For the 14 cases in which petitioners attempted to obtain access to the Supreme Court's agenda, I use the briefs filed to petition the Court to identify the petitioners and the respondents. For the 22 other cases that did not petition the Supreme Court, I artificially assign the role of "would-be petitioner(s)" to the party that lost at the CAFC simply based on the ruling and "would-be respondent(s)" to the opposing party. This solution is flawed because losing in the

CAFC ruling is a poor predictor of being a petitioner at the Supreme Court. For example, a patent holder can win a patent infringement suit but disagree on the penalty imposed on the infringer. In that case, the party that won at the CAFC would be the petitioner. Therefore, this exercise is conducted to compare the cases, but has limitations.

Seventy-eight litigants were involved in the 36 cases decided at the CAFC; some cases had several petitioners or respondents.[52] The data shows that there is no clear difference in the type of litigants involved in cases with and without a petition to the Supreme Court.

In the 14 cases that resulted in a petition to the Supreme Court, the petitioners were big businesses in 10 cases, individual inventors in 2 cases, and small businesses in 3 cases.[53] Among the 22 cases that did not petition the Supreme Court, the would-be petitioners were big businesses in 14 cases, an association of big businesses in one case, and small businesses in 5 cases.

Respondents in cases that involved a petition were big businesses in 9 cases, an association of big businesses in one case, an individual inventor in one case, and small businesses in 3 cases. Would-be respondents were big businesses in 13 cases, an association of big businesses in one case, individual inventors in 2 cases, and small businesses in 6 cases.

The distribution across technology fields[54] for cases with and without a petition to the Supreme Court is also relatively similar. Almost all the cases had petitioners and respondents in the same technological field. Over half the litigants were in industries related to information technology. The second most-represented area is the health sector with pharmaceutical firms,

[52] Firms that belong to the same corporation are counted as one litigant.
[53] The total exceeds 14 because some cases involve different types of petitioners.
[54] Technology fields are assigned based on company websites and Bloomberg. The categories used are broad (IT, finance, pharmaceuticals, medical technology, biotechnology, oil and gas, food and beverage, electrical devices, consumer services, automobile, IT services and processes, software, non-practicing entity, and machinery) because several stakeholders are diversified corporations. When diversification spans multiple technological fields, the field closest to the technological area of the patent(s) in question in the case was assigned based on the description of the patent(s) in court briefs.

biotech firms, and companies manufacturing medical technologies. Among all the cases, only the eBay case involved a litigant that was a non-practicing entity that would fit the description of a patent troll. Among cases that did not petition the Supreme Court, two cases belonged to technology fields not mentioned above: oil and gas and food and beverages.

In terms of conflict, there was also no clear difference between the two groups of cases. Among the 14 cases that petitioned the Supreme Court, 4 exhibited a conflict between the CAFC and the District Court on the question presented to the Supreme Court. Among cases that did not petition the Supreme Court, it is not possible to know which part of the CAFC decisions they would have petitioned the Supreme Court for, and, therefore, whether there was a conflict. However, among these 22 cases, in 5 cases the CAFC aligned entirely with the District Court's ruling; in 6 cases the CAFC affirmed in part, vacated in part, and remanded the District Court's ruling; in 9 cases it affirmed in part-reversed in part; and in 2 instances the District Court's decision was reversed.

4.4.3.2 Among petitioning cases: Granted v. not granted

Among the 14 cases that petitioned the Supreme Court,[55] 2 were granted *certiorari* while 12 were not added to the Supreme Court's agenda. The key difference that stands out between the groups is the number of amicus briefs filed. This is consistent with results found by prior studies (Caldeira and Wright, 1988; Chien, 2010).

In the eBay case, in addition to the 2 petitioners and 1 respondent, 6 amicus briefs in total were filed (5 on the petitioners' side, 1 on the respondent's side) by 46 amici to petition the Supreme Court. On the petitioner's side, including litigants, advocates were 35 scholars, 7 firms (big businesses), 4 associations of big businesses, and 2 interest groups. On the respondent's side, 3 large firms argued in favor of not placing this case on the Supreme Court's agenda.

[55] Listed in Appendix A

In the Microsoft case, there were a total of 67 stakeholders including litigants. Eleven amicus briefs were filed by 65 amici, and all were on the petitioners' side. Advocates including the litigants were 36 scholars, 21 big businesses, 4 associations of big businesses, 1 small business, and 3 interest groups that advocated in favor of placing this case on the Supreme Court's agenda.

None of the 12 cases that were not accepted on the agenda had amicus briefs filed by respondents. However, 7 cases had amicus briefs on the petitioner's side. The largest number of amicus briefs was 4 in Baxter International Inc. v. Frenesius Inc.[56] filed by one big business and 3 associations of big businesses. The second largest was Jazz Corporation and Dynatec International Inc. v. Fuji Photo Film Co. and the International Trade Commission,[57] which had 3 amicus briefs filed respectively by the US Department of Justice in favor of neither party, an association representing small businesses, and a big business. The third was Corevalve Inc. v. Edwards Lifesciences v. Streck, Inc.[58] in which two amicus briefs were filed by two interest groups. Two other cases had one amicus brief filed respectively by an interest group[59] and 2 associations of big businesses.[60]

The key differences in terms of stakeholders participating in cases that were granted *certiorari* is the large number of amici advocating in the petition phase (Table 11). In addition, the eBay case was the only case that had amicus briefs on both sides. Otherwise, both groups of cases were similar as the majority of stakeholders were big business and some of the amici were interest groups.

In terms of the number of types of entities (on a scale of 1 to 9), I find no difference in terms of litigants. The two cases that were accepted on the Supreme Court agenda involved two

[56] docket number 13-1071
[57] docket number 01-1158
[58] docket number 12-1325
[59] McFarling v. Monsanto, docket number 04-31
[60] ePlus Inc. v. Lawson Software Inc., docket number 15-639

types of litigants, while among the cases that were rejected one case involved 3 types, 7 cases involved 2 types, and 5 cases involved only one type of litigant. However, when considering all stakeholders, including amici, the eBay case and the Microsoft case both involved stakeholders of 5 different types. Among rejected cases, 1 rejected case increases its number of types from 3 to 4 types and 4 rejected cases increase from 1 to 2 types when accounting for amici. All others involved only one type of stakeholder.

Diversity of stakeholders is positively associated with being on the agenda of the Supreme Court, both in terms of the number of stakeholders and the number of types of stakeholders represented by the participants (H1).

In terms of the arguments (both legal and expert) made by stakeholders in the petition phase, for all the 68 briefs filed in the 14 cases that petitioned the Supreme Court, on average 18.6 legal arguments were made by brief, and the count varied between 0 (for two briefs only) and 56. On average, briefs filed in cases that were rejected by the Supreme Court made about 16.8 legal arguments, while briefs in the eBay case and the Microsoft case made 20.8 and 23.8 legal arguments on average, respectively. In absolute terms, a total of 212 and 430 arguments were made in the eBay case and in the Microsoft case, respectively. In rejected cases, the maximum number of arguments was 134 and the average maximum across cases was 57. Grants for review by the Supreme Court are associated with a higher diversity of arguments; therefore, H2a is not supported by the data. However, H2a cannot be refuted with confidence using this data set. The effect of diversity of argument cannot be detangled from the effect of diversity of stakeholders because most cases that did not read the agenda had no amicus briefs. As a result, I am not able to test the counterfactual: whether a case with a low diversity of stakeholders but high diversity of arguments can win.

A possible reason for this result is that, as documented by Epstein and Knight (1998), Justices are likely to anticipate unwanted outcomes in the merits phase when they make

certiorari decisions. In the following section on the policymaking phase (section 4.5), I find that the position supported by a higher diversity of arguments is more likely to win (H2b). This prediction is not verified because, as shown by studies on the Justices' strategic decision-making (Brenner and Krol, 1989; Caldeira et al., 1999; Epstein and Knight, 1998), even if the two phases of the policy process are separated in comparison to other policy settings, they are not hermetic from each other.

Table 11 Diversity of stakeholders and arguments in the agenda setting phase

	eBay case	Microsoft case	14 cases denied petition		
			Mean	Min	Max
Amicus briefs	6	11	0.9	0 (for 12 of them)	4
Diversity of stakeholders (entities)	49	67	0.8	0 (for 7 of them)	4
Diversity of stakeholders (types)	5	5	1.5	1 (for 6 of them)	3
Diversity of arguments	212	430	57.3	6	134
Legal arguments	187	334	53.7	6	123
Policy arguments	25	96	4.6	0	22

In terms of policy arguments based on citations of publications produced by experts, the average across all briefs in all 14 cases is 4.5, varying between 0 (for 35 briefs) and 23. On average, briefs in cases that were rejected by the Supreme Court made 2.8 policy arguments, while briefs in the eBay case and the Microsoft case made 5.9 and 9.0 policy arguments, respectively. A total of 53 and 126 policy arguments were made in the eBay case and the Microsoft case, respectively. On the other hand, for cases rejected from the Supreme Court's agenda, the maximum count is 31, and the average maximum across cases is 9. The data suggests that the

quantity of expert information used to support arguments made is positively associated to getting on the Supreme Court's agenda.

In terms of expertise based on stakeholder type, the two cases on the agenda are also the only ones with stakeholders from academia. Interest groups were also participants as amici in the two cases on the agenda and in one case that was denied a review. As a result, the eBay case and the Microsoft case involved 37 and 39 experts, respectively (Table 12), while all of the other cases involved zero experts, with the exception of the one rejected case in which interest groups participated as amici.

Both the difference in the number of policy arguments and in the number of expert stakeholders suggests that expertise is positively associated with being on the Supreme Court's agenda. A remarkable point in the data is that the majority of policy arguments are not made by experts; the great majority are cited by private actors, particularly big businesses. Based on this result, with two cases on the agenda with both expert information and expert advocates and 14 cases rejected from the agenda with significantly expert information and no expert advocated (Table 12), it is not possible to conclude whether the enlightenment hypothesis (H3a) or the legitimation hypothesis (H3b) better explain the role of expertise.

Table 12 Expertise in the agenda setting phase

	eBay case	Microsoft case	14 cases denied petition		
			Mean	Min	Max
Policy arguments	25	96	4.6	0	22
Experts	37	39	0	0	0

4.4.4 Discussion for the agenda setting phase

The key result of the case study on the agenda setting phase is that the diversity of stakeholders positively influences agenda setting in the judicial branch of government (H1), consistent with the legal literature that finds that amici participation contributes to being granted *certiorari* (Black and Boyd, 2012; Caldeira and Wright, 1990; Chien, 2010; Songer and Kuersten, 1995). Baumgartner and Jones (2015) view the diversity of stakeholders as important sources of diverse information and as quality control of information provided by other stakeholders. However, based on both the legal literature and the results that show no distinction between types of amici or arguments (legal v. expert), this factor seems to be a proxy of the importance of the policy problem.

The approach used to obtain empirical evidence on the agenda setting phase presents some limitations. First, it is a case study based on one policy topic. In addition, while the data set includes the entire population of cases in this policy topic at the Supreme Court, the sample size does not allow strong causal claims. Second, the sample of cases is collected based on the date of the decision of the CAFC. Using dates of petitions at the Supreme Court is not possible since part of the analysis aims to examine potential differences between cases that led to a petition and those that did not. In addition, this choice uses a point in time at which the litigants have obtained the ruling for their last recourse and the decision to petition the Supreme Court can be made. A drawback from using this date for data collection is that the time petitioners take between the CAFC decision and the petition to the Supreme Court varies. Interpretations of this lag are lacking in the literature to the best of my knowledge and data that can be used to examine the reasons for delaying a petition are not easily accessible. Third, Supreme Court Justices are not isolated policymakers. They may be influenced by the saliency of an issue in their *certiorari* decision. To control for a change in the saliency of the topic (Larsen, 2012) examined in the case study, which may have influenced the Supreme Court's acceptance of the

eBay case and the Microsoft case, I conducted a Google keyword search of the words "patent troll" and of "holdup" within the Business & Industry category. Figure 6 represents the number of searches scaled to values between 0 and 100 based on the maximum count of searches in the period 2004-2012. The eBay case was granted *certiorari* on November 28, 2005 and the Microsoft case was granted *certiorari* on November 29, 2010. This is a simplistic verification based on noisy information. Nevertheless, I do not find a clear correlation between the saliency of the policy topic and the timing of the grants of *certiorari*.

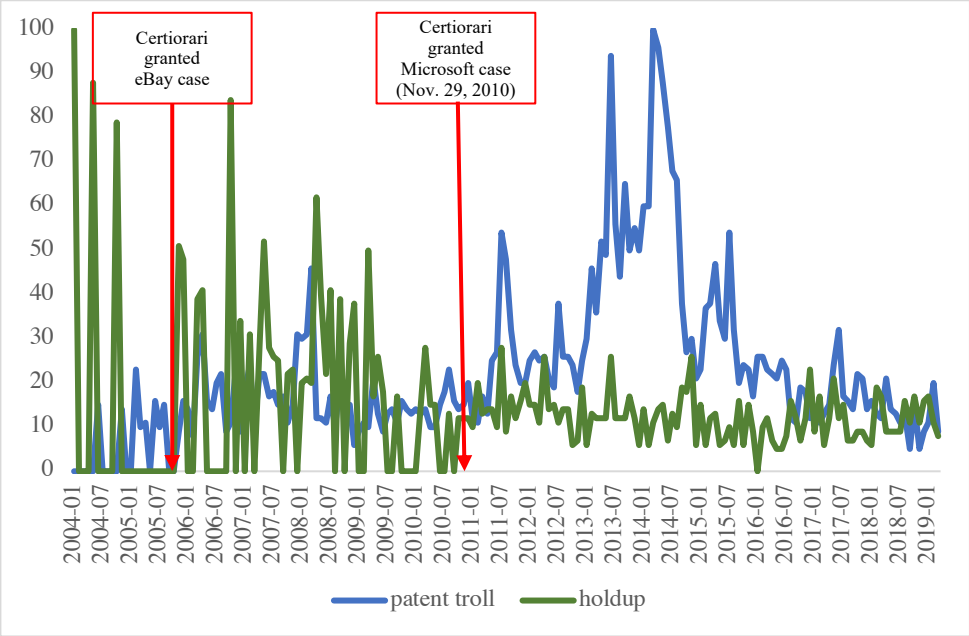

Figure 6 Google keyword search

Source: Google

4.5 Longitudinal Analysis of Patent Policymaking

This section provides an empirical analysis of the role of information in the policymaking phase. In this phase, the policymaker (US Supreme Court) decides on the cases that are on its agenda by selecting a winning side and a losing side. Stakeholders argue by providing both legal and expert arguments supporting their side. An important question in this section is whether expert

arguments influence policy decisions, and whether the effect is due to learning from the content or to the legitimacy that expertise provides.

4.5.1 Data

I use the entire population of patent-related US Supreme Court cases decided over the period 2000-2015. I collect all the parties' briefs, amicus briefs, and opinions of the Court for the 31 cases (listed in Appendix B). By scraping the 885 briefs submitted by stakeholders (litigants and amici), I construct a data set that contains information on the outcome of the cases and the participation of 1,156 unique stakeholders, leading to a total of 2,549 participation observations.

For the 517 stakeholders that are firms, characteristics are obtained from Compustat, the reference website USA.com, company website information, and the description of amici in amicus briefs. In addition, names of the stakeholders are matched against the Senate Office of Public Record (SOPR) over the period 2000-2015 to collect information for the number of lobbying actions undertaken by the stakeholders in Congress and the amounts spent in lobbying.

Using court documents, I classify each of the 31 cases into corresponding aspects of strength: 1) patentable subject matter, 2) breadth of interpretation of claims, 3) ability to exclude, and 4) administrative and other. Given that some concepts in the different aspects of strength overlap, some cases are assigned more than one category. Categorizing the cases allows for a consideration of stable policy topics on decisions made over time.

Using the 31 *opinions* written by the Supreme Court to deliver their final ruling and the briefs filed by stakeholders, I scrape legal precedent citations and citations of publications produced by experts to respectively proxy the legal arguments and policy arguments that were made by stakeholders and policymakers. I make inferences about the influence of stakeholders on final decisions based on the overlap on the two kinds of arguments. As discussed in the limitations section, however, there are alternative explanations to this correlation that threaten the robustness of the causal claims made in this study.

4.5.2 Approach

To examine the effect of variables related to the concept of entropic information, diversity within a coalition, defined as a group of stakeholders advocating for the same outcome, is central. Therefore, I use a case-side as the unit of analysis. In other words, for each of the 31 patent-related Supreme Court cases, I have two observations: the petitioner(s) side and the respondent(s) side. Given that I am interested in understanding the relationship between the diversity of information and success in influencing the policy adopted in the policymaking phase, I reassign the two sides for each case into the winning side and the losing side based on the ruling on the case.

As a result, I use a data set with 62 observations to analyze the relationship between diversity in stakeholders and diversity in arguments with success in the policy outcome. I conduct a comparison between the winning and losing side. Given the size of the data set, statistical inferences are limited.

Another limitation in this study is that it may ignore policy decisions that were implemented by rejecting a case in the agenda setting phase. Nevertheless, if the decision is sufficiently important (Rule 10), the Supreme Court can perform "aggressive grants" by reviewing a case even when they approve of the lower court's ruling in order to affirm it and make this decision uniformly across lower courts (Cameron et al., 2000). Therefore, in this discussion, I make two assumptions. First, I assume that a case being placed on the Supreme Court's agenda is indicative that an important policy change is at stake. Second, the incentive to try to influence the Justices is not limited to the petitioners. Stakeholders on the respondents' side are also actively trying to influence a policy decision in both phases of the policy process.

To examine the effect of expert information and expert participation on the policy outcome, I structure the data set in a different manner. The focus is on tracking the influence of

stakeholder behavior and the information they provide. Therefore, the analysis is conducted on a disaggregated version of the data with stakeholder-year as the unit of analysis.

4.5.3 Descriptive statistics

4.5.3.1 Setting

The Supreme Court ruled over 31 patent-related cases over 2000-2015, of which 4 were under the Rehnquist Court and 27 under the Roberts Court. Twenty-one of the cases were unanimously decided. Among the 10 non-unanimous cases, one Justice dissented alone in 3 cases, two Justices dissented in 5 cases, and three Justices dissented in 2 cases. This is consistent with the claim that patent cases have remained a relatively non-partisan topic over the period of study (Sag et al., 2009). Therefore, whether they are influenced by information provided by stakeholders remains an open question.

Among the 31 cases, the patent holder is the petitioner in 7 cases and the respondent in 24 cases. The winner was holding the patent in question in 12 of these cases (Table 13). Among the 20 cases won by the petitioners, 4 of them were patent holders. Among the 11 cases won by respondents, 8 were won by respondents that were patent holders. There does not seem to be any systematic preference of the court in favor or against patent holders.

The three policy "topics" determined by the three aspects of patent strength are non-exhaustive and non-exclusive (Table 13). Among the 7 cases on patentability,[61] 3 cases made changes strengthening that aspect of patent strength. In 3 cases, the question tackled concerned the breath of patents and two of them strengthened this aspect. Lastly, among the 22 cases related to exclusivity, 7 strengthened this aspect and 15 weakened it.

[61] Subject matter involved were plants, software, business methods, medical tests, genes, processes, and one case tackled the obviousness criterion.

Table 13 Supreme Court patent-related cases

	Number of cases	Percentage of cases (out of 31)
Petitioner held patent	7	22.5
Respondent held patent	24	77.4
Petitioner won	20	64.5
Respondent won	11	35.5
Petitioner who held patent won	4	NA
Respondent who held patent won	8	NA
Patent topic		
Patentability	7	NA
Breadth	3	NA
Exclusivity	22	NA

The average number of parties involved is 4.0, with 1.6 on the winning side and 2.3 on the losing side (Table 14). In addition to the petitioner(s) and respondent(s) briefs, on average, 23.7 amicus briefs are submitted by 77.3 stakeholders. The number of amicus briefs on the winning side was 10.3 on average as opposed to 9.0 on the losing side. The number of stakeholders was also slightly higher on the winning side with 37.8 stakeholders against 30.8 on the losing side on average.

The total of 2,549 stakeholder-year observations is not evenly distributed over time. The number of stakeholders trying to influence the court increased overall over the period between 2000 and 2015 (Figure 7). The proportion of participations (stakeholder-year) by entity type is the following: 27.5% were individuals who were academics, 6.1% were academic institutions (e.g. universities), 4.8% were NGOs (non-profit organization other than firm associations), 19.8% were small businesses, 6.9% were associations representing the interests of small businesses, 23.3% were big businesses, 2.0% were associations representing the interests of big businesses, and 6.1% were governmental organizations. The remaining stakeholders were essentially individuals who were not academics (e.g. inventors or law practitioners) and law firms.

At the case level, 27.6 experts participated on average. Among those experts, 22.6 were scholars, 5.1 were universities, and 3.9 were interest groups. The average number of policy arguments made in a case by any type of stakeholder was 53.1.

Among all the 1,156 unique stakeholders, 54 had lobbied at least once during the period of observation. The number of lobbying actions in Congress among these 54 entities was 5 on average and the maximum was 35 for the company Red Hat Inc. The average amount spent on lobbying was USD1.5 million and the maximum was USD41.3 million by the US Chamber of Commerce. The great majority of lobbing actions occur between 2006 and 2010. This mitigates the concern about using lobbying history with data left-truncated in 2000.

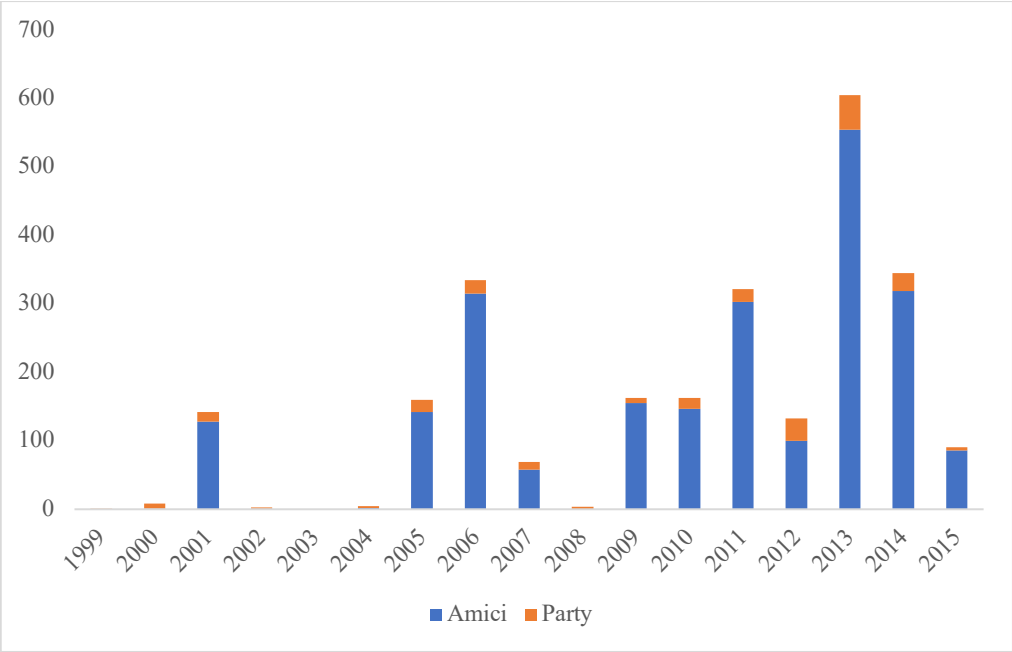

Figure 7 Number of stakeholders participating as party and amici

For each case, the Supreme Court delivers its decision in an opinion justifying the final ruling, often relying on legal precedents and research-based references. The number of legal arguments used in opinions was on average 20.2 varying from 5 to 48, and policy arguments was on

average 10.3 and varied between 0 and 22 (Table 14). There is no clear temporal trend in the quantity of arguments made; the number of legal precedents referenced seems to be specific to each case.

The number of legal precedents cited by each participation (stakeholder-year considering both parties and amici as stakeholders) also does not present a clear trend over time. On average, stakeholders made 22.3 legal arguments and 9.2 policy arguments.

Table 14 Stakeholder participation by case

	Obs.	Mean	Std. Dev.	Min	Max
Party	31	3.96	3.72	2	21
Amicus briefs	31	23.71	18.11	0	75
Amici	31	77.29	68.47	0	257
Stakeholders	31	81.26	69.15	3	260
Experts	31	27.58	31.77	0	144
Legal arguments by all briefs (unique)	31	287.64	139.32	110	741
Policy arguments by all briefs (unique)	31	53.06	45.51	0	180
Arguments by all briefs (unique)	31	340.71	167.39	110	884
Legal arguments in opinion	31	20.19	10.81	5	48
overlapping with briefs	31	13.74	7.34	3	31
Policy arguments in opinion	31	4.32	8.73	1	50
overlapping with briefs	31	0.19	0.65	0	3
Arguments in opinion	31	24.52	17.12	6	98
overlapping with briefs	31	13.93	7.69	3	33

Note: For each case, unique cases cited in briefs by all stakeholders (aggregated as a group) are counted for each type of argument.

Table 15 Arguments by participation (stakeholder-year level)

	Obs	Mean	Std. Dev	Min	Max
Arguments	2,549	31.55	21.82	0	145
overlapping with opinion	2,549	6.71	3.76	0	23
Legal arguments	2,549	22.30	16.12	0	133
overlapping with opinion	2,549	5.51	3.26	0	22
Policy arguments	2,549	9.25	12.82	0	52
overlapping with opinion	2,549	1.20	0.85	0	16

Note: For each type of argument, count of unique citations by each participation.

4.5.3.2 Key variables of interest

The two outcomes of interest in this study are which side wins a case and who influences the language of the policymaker's decision. There is a winning side and a losing side in each case, and the findings section examines the factors associated with each side. In terms of overlap between policymakers' and stakeholders' arguments, from the point of view of a stakeholder as the unit of analysis, the number of arguments that overlap with the opinion of the cases in which a stakeholder participated was on average 5.5 legal arguments, and 1.2 policy arguments (Table 15). On the other hand, from the point of view of a case as the unit of analysis (Table 14), on average, 12.7 of the legal arguments made in opinions overlapped with the legal arguments made by stakeholders and 0.2 policy arguments overlapped with those of stakeholders.

The key explanatory variables in this study are two diversity measures related to the notion of entropic information and two aspects of expertise. First, in relation to the notion of entropy of information, the data allows variation across cases based on the data set using the case as the unit of analysis (Table 16). The diversity of stakeholders is on average 81.2 when it is measured by a count of distinct stakeholders that participate in a case. The average is 6.6 when it is measured by types of stakeholders.

The diversity of arguments is 340.7 on average, measured as the count of unique arguments made by all stakeholders in a case (Table 16, same as in Table 15). The count of arguments is the sum of legal arguments, proxied by legal precedents cited, and policy arguments, proxied by the number of citation of publications produced by experts.[62] The diversity of legal arguments only is 287.6 on average by case.

[62] Academics and interest groups excluding firm associations as detailed in section 4.3.2.2

Table 16 Diversity of information at the case level

	Obs	Mean	Std. Dev	Min	Max
Diversity of stakeholders (entities)	31	81.26	69.15	3	260
Diversity of stakeholders (types)	31	6.58	1.84	1	8
Diversity of legal arguments	31	287.64	139.32	110	741
Diversity of policy arguments	31	53.06	45.51	0	180
Diversity of arguments	31	340.71	167.39	110	884

At a participation level, experts represent 33.5% of all participations. On average, a participation by any type of stakeholder involves 2.4 policy arguments. The use of expert arguments is lower for experts who make an average of 1.8 policy arguments by participation. In comparison, non-experts make 2.7 policy arguments. The difference in the number of legal arguments and total arguments between the two groups suggests that experts seem to make fewer arguments in their briefs in general. This indicates that experts' briefs tend to be more narrowly written. This may be because experts such as academics tie the briefs to their own work. This behavior can also indicate a strategy to focus the Court's attention on fewer arguments.

Table 17 Expert information at the participation level

	Obs	Mean	Std. Dev	Min	Max
Experts	2,549	0.33	0.47	0	1
Policy arguments	2,549	2.41	4.94	0	36
by experts	855	1.84	3.70	0	36
by non-experts	1,696	2.70	5.44	0	31
Legal arguments	2,549	21.91	15.94	0	132
by experts	855	18.71	11.07	0	55
by non-experts	1,696	23.52	17.68	0	132
Arguments	2,549	24.32	17.23	0	133
by experts	855	20.55	10.89	2	61
by non-experts	1,696	26.22	19.39	0	133

4.5.4 Findings

4.5.4.1 Unit of analysis: case level

The outcome from the point of view of participating stakeholders is for their side to win. However, from the court's point of view, there is always one side that wins and another that loses. Therefore, to understand what influences the Supreme Court in choosing which side wins, I am interested in differences in the diversity of participants and arguments between the winning side in comparison with the losing side.

The data at the case level includes 62 observations because for the purpose of this analysis, I consider each side of the 31 Supreme Court cases as units of analysis. This is insufficient for conducting a meaningful statistical analysis. Therefore, this section analyzes the effect of the diversity of stakeholders and diversity of arguments based on correlations and discusses potential implication for causal relations.

The winning side has a higher diversity of stakeholders advocating than the losing side, both in absolute number of stakeholders and in the number of types represented (Table 18). However, the difference is not significant. The winning side has 39.4 stakeholders on average, while the losing side has 33.2. In terms of the type of participants, the winning side has 6.2 types of participants while the losing side has 5.8 on average. These results are consistent with the focus on the role of diversity of stakeholders in the agenda setting phase verified by a test of H1 based by Baumgartner and Jones (2015). The findings do not support a significant effect of diversity of stakeholders in the policymaking phase.

For the diversity of arguments, the stakeholders on the winning side make 310.0 arguments on average, which is statistically larger than that of the losing side, which makes 214.6 arguments (Table 18). This result supports H2b: the position supported by a higher diversity of argument is more likely to win in the policymaking phase.

It is worth noting that the result is driven by legal arguments, and the difference is actually the opposite for policy arguments. In terms of legal arguments, the winning side makes 287.6 legal arguments and the losing side makes 182.7, by a statistically significant difference. On the other hand, the winning side makes 22.5 policy arguments, a number that is statistically smaller than the 31.9 policy arguments made by the losing side. I examine the difference in arguments (total and each type) used in the 10 cases in which the winning side made more policy arguments. I find no significant difference in citation patterns with cases in which the winning side made fewer policy arguments. This observation supports the view that the type of argument made does not matter compared to the diversity of arguments, all types confounded.

Table 18 Difference in diversity of information between the winning side and the losing side (N = 31 on each side)

	Obs.	Diff = losing side – winning side	t-stat	p-value
Diversity of stakeholders	62	-6.19	-0.626	0.267 (Diff < 0)
Diversity of types of stakeholders	62	-0.35	-0.560	0.289 (Diff < 0)
Diversity of arguments	62	-95.42**	-2.709	0.004 (Diff < 0)
Diversity of legal arguments	62	-104.97***	-3.296	0.001 (Diff < 0)
Diversity of policy arguments	62	9.55*	1.408	0.082 (Diff > 0)

	Winning Side				Losing Side			
	Mean	Std. Dev.	95% confidence interval		Mean	Std. Dev	95% confidence interval	
Diversity of stakeholders	39.42	7.88	23.66	55.18	33.22	5.98	21.26	45.19
D. of types of stakeholders	6.16	0.44	5.27	7.05	5.81	0.45	4.90	6.71
D. of arg.	310.03	148.52	255.55	364.51	214.61	128.11	167.62	261.60
D. of legal arguments	287.64	139.32	236.54	338.75	182.68	109.71	142.43	222.92
D. of policy arguments	22.39	24.82	13.28	31.49	31.93	28.46	21.49	42.38

4.5.4.2 Unit of analysis: participation level

To examine the relationship between stakeholders' use of expert information and decisions in the policymaking phase, I estimate its effect using two measures for the outcome using the panel data set at the participation level. The binary variable captures being on the *winning* side, and the count variable captures *arguments* made by a stakeholder that overlaps with the arguments in the opinion.

I use two measures of expert information. First, I use the binary variable of being an *expert*. Second, I use the count of *policy arguments* made, which relies on citations of documents that have been produced by experts.

In the main models, I control for the logged count of total legal arguments made by the court, as a proxy for the weight of past decisions. I also control for being part of the "*haves*" using the logarithm of the amount spent in lobbying in the three years prior to the action of the stakeholder in court. This measure is preferred over the binary measure based on stakeholder type to avoid multicollinearity issues with the expert variable.

A correlation check shows that being an expert is correlated in a positive and significant way with both being on the winning side and providing arguments that overlap with those used by the courts in their opinion. On the other hand, providing policy arguments has a positive and non-significant correlation with both outcomes.

Table 19 Correlation matrix (N = 2,549 at stakeholder-year level)

		1	2	3	4	5	6
Winning	1	1.0000					
# Argument in opinion	2	0.1376*	1.0000				
# Policy arguments (logged)	3	0.0280	0.0152	1.0000			
Expert stakeholder	4	0.1208*	0.1001*	-0.0822*	1.0000		
Lobbying amount 3 year (logged)	5	0.0143	0.0036	0.0019	-0.0802*	1.0000	
Weight of past decisions	6	0.0129	0.4552*	0.0540*	0.0539*	0.0143	1.0000

Note: * significant at 0.05

The results suggest that being an expert is positively related with both outcomes in the policymaking phase (Table 20). On the other hand, using expert arguments is not significantly associated with either outcome (Table 21).

The results are driven by the citing behavior of the two types of stakeholders. As noted previously in section 4.5.3.2, experts tend to make significantly fewer citations for both legal and policy arguments. Since experts are often associated with the winning side (Table 20), fewer citations of expert information is associated with a lower likelihood to succeed in the policymaking process. Therefore, the relationship between expert information and the success of Supreme Court cases should be examined with a distinction between the two groups and controlling for citing behavior.

First, noting that a majority of stakeholders, among both experts and non-experts, do not use expert information in their briefs, I examine the differential effect between the two groups, using expert information as a dummy that does not account for the number of arguments made.

I test the difference between the marginal effects of using expert information between the two groups. First, I find that when neither experts nor non-experts use expert content in their arguments, experts are significantly more likely to be on the winning side and significantly more likely to have overlapping arguments with the opinion compared to non-experts (Figure 8). This result strengthens the previous finding in Table 20 that showed that experts' status is associated with being influential on policy outcomes, whereas using expert content to support arguments is not. Second, I find that by using expert information, the difference in the probability of experts and non-expert of being on the winning side is not significantly different from zero (Figure 9). On the other hand, experts remain significantly more likely to have overlapping arguments with the opinion compared to non-experts, regardless of whether both groups use expert information.

Table 20 Experts and Policymaking

	Winning Logit (1)	Arg. in opinion Poisson (2)
Expert	0.569***	0.137***
	(0.162)	(0.029)
Weight of past decisions	0.016	0.558***
	(0.101)	(0.020)
Haves	-0.064	-0.000
	(0.065)	(0.012)
Constant	0.031	-0.229***
	(0.315)	(0.063)
Cst. alpha		-2.310***
		(0.100)
Obs.	2,549	2,549
Entity ID	1,155	1,155
Log-likelihood	-1647.5536	-5916.6057
Wald chi2 (3)	13.71	842.22
Prob > chi2	0.0033	0.0000

Note: * significant at 0.10, ** significant at 0.05, *** significant at 0.01. Standard errors are in parenthesis.

Table 21 Expert information and Policymaking

	Winning Logit (1)	Arg. in opinion Poisson (2)
Expert argument	0.007	-0.001
	(0.011)	(0.002)
Weight of past decisions	0.032	0.563***
	(0.101)	(0.020)
Haves	-0.075	-0.003
	(0.066)	(0.012)
Constant	0.007	-0.192***
	(0.011)	(0.063)
Cst. alpha		-2.272***
		(0.099)
Obs.	2,549	2,549
Entity ID	1,155	1,155
Log-likelihood	-1653.2847	-5915.9537
Wald chi2 (3)	2.44	840.18
Prob > chi2	0.4868	0.0000

Note: * significant at 0.10, ** significant at 0.05, *** significant at 0.01. Standard errors are in parenthesis.

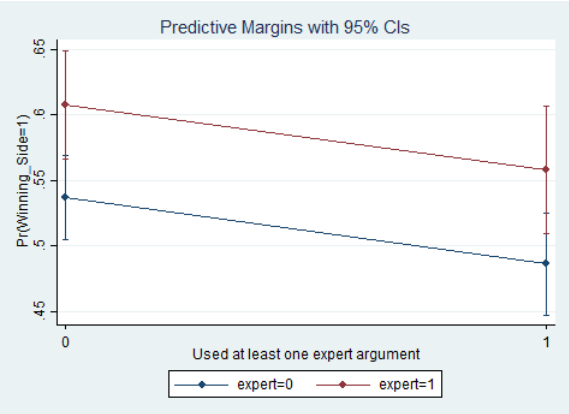

Figure 8 Use of expert information (binary) and policy decision (binary – win/lose)

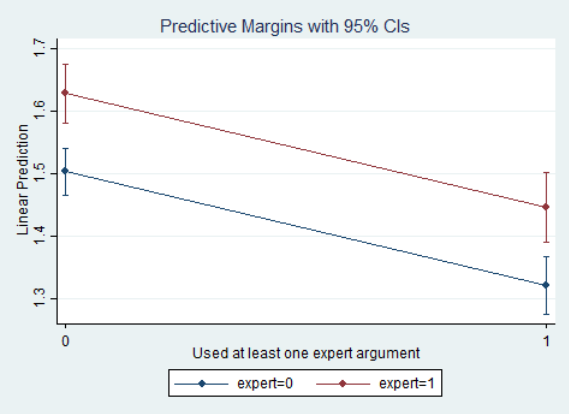

Figure 9 Use of expert information (binary) and policy language (count- arguments)

Results presented up to this point suggest that the legitimacy hypothesis (H3b) is better able to explain the role of expertise in the policymaking phase than the enlightenment hypothesis (H3a).

I conduct a further examination of the difference in the use of expert information between experts and non-experts by reiterating the test with a count variable instead of the binary variable. Accounting for the variation in the number of expert arguments made in briefs (Figure 10), I find that non-experts can close the gap with experts in terms of both the probability of being on the winning side and of having overlapping arguments with the opinion by making a large enough number of expert arguments. The threshold is about 12 expert arguments for the probability of being on the winning side and about 14 expert arguments to have a similar level of overlap with the Court's opinion (Figure 10).

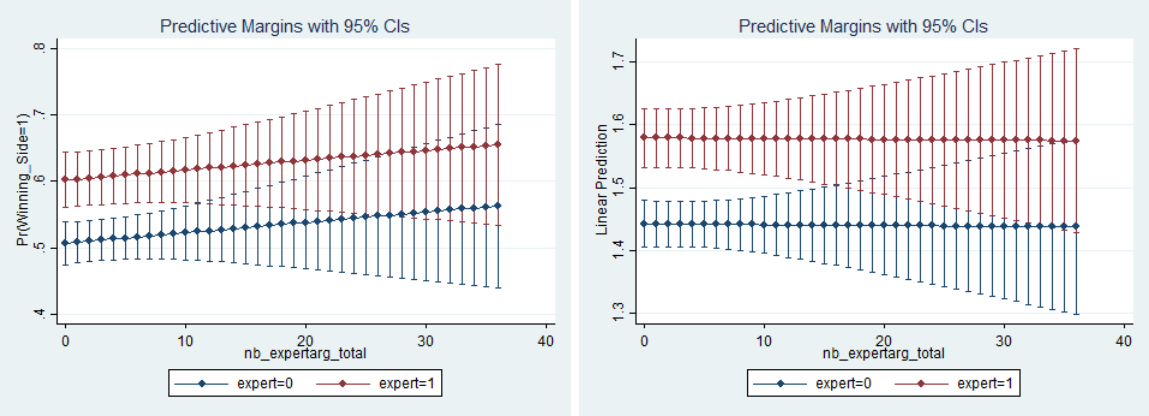

Figure 10 Use of expert information (count) and Policymaking

Empirical findings suggest that being an expert is positively associated with success in the policymaking phase (Table 19 and Figure 8) and that expert information does not have a significant effect in itself (Table 18 and Figure 8). These results support the conclusion that the legitimacy hypothesis (H3b) is better able to explain the role of expertise in the policymaking phase than the enlightenment hypothesis (H3a). Additional findings show that nevertheless, non-experts can use arguments supported by expert content to reduce the difference with experts in how they affect both the ruling and the language of the decision (Figure 9). This result does not definitively support either hypotheses because this effect could be either due to the need for an accumulation of evidence to "enlighten" the policymaker, or to the increased legitimacy provided for stakeholders from using expert evidence.

4.5.5 Discussion for the policymaking phase

The key findings of the analysis of the policy making phase are the following. First, stakeholders who provide diverse arguments are more likely to win in the policymaking phase (H2b). Baumgartner and Jones (2015) focus on the role of diverse information to order chaotic information environments based on policy settings with a larger set of problems than the courts usually deal with. As a result, they overlook the explanation supported by this result: policymakers are likely to value the use of a variety of arguments to support their decision.

Another key result of this section is that the legitimacy hypothesis (H3b) is better able to explain the role of expertise in the policymaking phase than the enlightenment hypothesis (H3a). This finding provides more nuance in the role of expert information, which is viewed by Baumgartner and Jones (2015) as a way to enlighten policymakers in their decision-making.

To test the robustness of the results, I control for the potential effects that are specific to policy topics. Second, I control for the *type of stakeholder*, and I alter to model to only use the count of policy arguments as a measure of expert information to avoid collinearity issues because the binary variable expert is constructed based on stakeholder type. Third, I control for year fixed effects to account for *saliency*, which is meant to capture other streams of information that could affect how policymakers frame problems and solutions independently of the information given by stakeholders.

To account for as much of the information available to the Supreme Court when the decision is made as possible, I include both briefs in the *certiorari* and in the *merits* phase for the analysis of decisions in the *merits* phase. Future work based on this thesis will test the robustness of the results by limiting the data set to briefs that are only on the *merits*. Also, the analysis can be made more precise by distinguishing all arguments made by lower courts from the arguments made by stakeholders to remove information that the Supreme Court already possesses about a case. Additional nuance can be introduced on the timing of information supplied by differentiating between arguments used by lower courts, new arguments in the petition phase by stakeholders, and new arguments in the *merits* phase.

Effects due to the "haves" status could also be controlled by accounting for stakeholders' prior participation. Future work on this topic can control for the role of lawyers using information about their lobbying experience gathered from www. lobbyist info.

One limitation of this study is that it considers the Supreme Court as an aggregate decision-maker. Future work on this topic may conduct a similar analysis using a multinomial

logistic regression using Justices' votes as an outcome. Such an approach would allow empirical tests to be conducted by examining one or more Justices, often referred to as the "swing vote," whose vote is not predicted by party affiliation. As a result, this method would allow the findings of this dissertation to be tested on topics beyond patent issues, even if partisanship is involved in decision-making to some extent.

4.6 Conclusion

The findings in this chapter provide new insights regarding the role of diverse information and deep information (expertise) in both phases of the policy process. The diversity of stakeholders positively influences agenda setting in the judicial branch of government (H1). This result is consistent with empirical findings in the legal literature that show that the participation of amici is a key factor in being granted *certiorari* (Black and Boyd, 2012; Caldeira and Wright, 1990; Chien, 2010; Songer and Kuersten, 1995). This effect is true regardless of the side that is being supported (Shapiro, 1984). Based on this literature and the results, in the agenda setting phase of the judicial branch of government, the diversity of stakeholders is viewed as an indicator of the importance of a policy problem, which is different from the reason presented by Baumgartner and Jones (2015): desirability as sources of diverse information and as controllers of the quality of information provided by other stakeholders. In the policymaking phase, consistent with H1, the empirical evidence cannot reject the prediction that the diversity of stakeholders does not influence the ruling in the *merits* phase of the Supreme Court. This finding shows that the role of diversity of information differs in the judicial branch of government compared to the argument by Baumgartner and Jones (2015) based on the elected branches of government.

Contrary to the prediction that the diversity of arguments is not influential in the agenda setting phase in the judicial branch of government (H2a), I find that briefs in cases that were granted *certiorari* presented a wider variety of arguments than those that did not. There is a

high probability that this is due to the limitations of the data. While this limitation should be kept in mind, the finding is consistent with the fact that Justices are sophisticated, strategic actors who try to anticipate outcomes in the policymaking phase when they make decisions in the agenda setting phase (Brenner and Krol, 1989; Caldeira et al., 1999; Epstein and Knight, 1998). I find that stakeholders who provide diverse arguments are more likely to win in the policymaking phase (H2b). This outcome in the policymaking phase could be anticipated by the Justices when they make decisions in the agenda setting phase. As a result, the anticipation of the policymaking phase outcome could affect the results for H2a. Nevertheless, the finding (H2b) suggests that diversity of information also plays a role in policymaking when it comes to the judicial branch of government. This is explained by the fact that Justices are likely to value the ability to use a variety of arguments to support their decision. This explanation differs from the argument presented by Baumgartner and Jones (2015) based on other policy settings: diversity of information helps to order a chaotic information environment.

This study examines two rival hypotheses on the role of expertise in the two phases of the policy process. Stakeholders can exhibit expertise through their identity (academics, interest groups) or by presenting arguments that rely on expert information. I find that the expertise of the source of the information has a significant positive relation with a case accessing the agenda and a side winning on the *merits* phase. In addition, I find that the amount of expert information as content in the briefs is associated with cases accessing the agenda of the Supreme Court. However, it is also collinear with having experts as advocates. Therefore, the case study used in this chapter is not sufficient to make claims regarding a causal effect. In the policymaking phase, experts are positively associated with success, while the use of expert information is not. Success is measured in two ways: as being on the winning side of a case and as having overlapping arguments with the final decision. This suggests that the legitimacy hypothesis (H3b) is a better able to explain the role of expertise in the policymaking phase than the

enlightenment hypothesis (H3a). This conclusion differs from the view that expert information is valuable in helping policymakers design better policies (Baumgartner and Jones, 2015), which is close to the enlightenment hypothesis. However, I also find that expert information used by non-experts can reduce the gap with experts in terms of the probability of success on these two measures of outcome. Therefore, the role of expertise as content used to enlighten policymakers cannot be entirely ruled out (H3a).

The conclusions from this chapter have important policy implications. First, the study improves our understanding of how information can be used in court, for cases beyond patent cases. The generalizability of the findings is bounded by the extent to which stakeholders can influence the courts. Depending on the situation, the applicability of the results may be limited to a swing Justices, for example. Second, the insights from this chapter are also applicable to other policy settings. Depending on the organizational structure of the policymaking apparatus, there will be differences in resources allocated to collecting and processing information and in the size of the set of problems and solutions policymakers handle. Therefore, the applicability of results on the diversity of information should be carefully considered on a case-by-case basis. On the other hand, the findings on the use of expertise by policymakers are directly applicable to all elected policymakers who need legitimacy.

5 CHAPTER 5 IMPLICATIONS AND CONTRIBUTIONS

Overall, this dissertation studies the co-construction of patent policy and stakeholders' strategy in the courts. The research questions tackle fundamental issues in the economics of innovation and in policy process theory. The dissertation relies on several methodological improvements to support the theoretical contributions with empirical evidence. Both have academic, policy, and managerial implications in improving our understanding of how patent policy shapes stakeholders' innovation strategy and how stakeholders' strategy in turn shapes policy.

This dissertation begins by reviewing the literature from a set of disciplines on the role of different types of information (policy process literature), the decision-making process in the Supreme Court (legal and political science literature), and the impact of patent policy on innovation (economics of innovation literature). This dissertation makes the following contributions to fill gaps in the literature that have developed as these streams of research have evolved separately. In addition, the findings have implication for managers and policymakers.

The first contribution of this dissertation addresses a fundamental research question in the economics of innovation literature: the long-debated relationship between patent strength and innovation. To confront the numerous theories in the existing literature predicting changes in firm strategy leading to both increases and decreases in innovation, a mixed-methods approach is used by combining interviews and an analysis of court documents with quantitative estimations of the impact using a panel data set of patent and firm data to examine the mechanisms behind patent policymaking and firm strategy. Using an exogenous shock and a novel methodological approach, I provide empirical evidence that a decrease in patents' ability to exclude (one aspect of patent strength) can lead to more investments in innovation and a reduction in patenting. The uniform rate observed across firm types is explained by different underlying mechanisms contingent on industry and resources. Unsurprisingly, stakeholders who argued in favor of the policy that was eventually adopted increased their investments in

innovative activities. The more remarkable finding is that stakeholders who sided against the policy adopted also increase their R&D investments, even though they argued that the resulting decrease in patent strength would reduce their incentive to invest in innovation. The data suggests that the lower ability to exclude using patents may force firms to shift the composition of their innovative activities in order to adapt to a disadvantageous change in their institutional environment rather than to abandon the use of innovation as a source of competitive advantage. This result has two implications. First, the behavior of stakeholders on the losing side of the eBay case shows that, in the current knowledge-based economy, innovation is an indispensable source of competitive advantage for many firms. Therefore, stakeholders have high stakes attached to patent policy and have incentives to attempt to shape patent policy to their advantage. This indicates that patent policymakers make decisions that impact large firms' investments and cannot be abandoned to compete in our knowledge-based economy. Second, patent policy shapes stakeholders' innovation strategies and the impact of patent policy is heterogeneous and contingent on the type of stakeholder. Therefore, when policymakers like the Supreme Court make decisions that alter the patent system, they are in effect creating winners and losers who belong to different technological areas and have different levels of resources. Therefore, a key implication for policymakers from all three branches of government is that they should acknowledge that patent policy is a form of industrial policy that impacts essential factors of competitive advantage when they are evaluating policy alternatives to choose from.

This dissertation provides empirical insights regarding the functioning of policy process for patents. Such insights are valuable for firms that rely on innovation and patents. In addition, policymakers involved in various parts of the patent system can also benefit from a better understanding of how the Supreme Court, an actor that has become central in patent policy relatively recently, makes decisions and the roles stakeholders play in the process. To facilitate the understanding of patent policymaking in the Supreme Court, I present key facts and existing

academic findings about the Supreme Court as a policymaking entity in general and for patent policy in the form of a primer.

The primer reveals characteristics about the policy process in the judicial branch of government that differ from policy settings traditionally tackled by the policy process literature focused almost exclusively on the elected branches of government, the states, or local governments. The difference in organizational structure as well as the constraints and incentives under which policymakers build their agenda and choose between policy alternatives motivates a test of existing insights from the policy process literature in which courts are absent.

Baumgartner and Jones (2015) present a theory of the role of two types of information in different phases of the policy process based on policy settings in the other branches of the government. Information as diversity is expected to help considering a broad view of the world to select problems on which to focus in the agenda setting phase. On the other hand, expertise is expected to help find the best policy solution to solve those problems in the policymaking phase. A theoretical contribution of this dissertation is to propose a theory of the policy process in the judicial branch of government, building on predictions made by Baumgartner and Jones (2015) in light of 1) the legal and political science literature on the role of stakeholders and information in Supreme Court and 2) the policy learning and organizational theory literature on the strategic use of information. An empirical contribution of this dissertation is to test those predictions using a research design and data that solve for traditional empirical challenges related to identification and measurement faced by studies examining the relationship between stakeholders and policymakers, including Baumgartner and Jones (2015). I use all US Supreme Court patent cases over the period from 2000 to 2015 as the empirical setting to provide an understanding of the effect of the participation of stakeholders (as parties in a case, amici, or through lobbying) on the decisions that change patent strength.

Some findings considering the judicial branch of government are similar to predictions made for the elected branches of government: information as diversity and expertise are influential in the agenda setting phase and the policy making phase, respectively. However, their role is not restricted exclusively to one of the phases. I also find dissimilarities: the diversity of arguments by stakeholders is associated with winning in the policymaking phase and expertise matters in both phases of the policy process. In addition, I find some nuance in the role of expertise. I find that expertise is not principally used as content to an argumentation meant to convince policymakers. The stronger importance of the expert status of stakeholders over arguments that rely on expert knowledge shows that expertise is mainly used to legitimize a position in the policymaking phase (and evidence is not conclusive for the agenda setting phase). I argue that these results are due to differences in the organizational structure, constraints, and incentives in the Supreme Court compared to the elected branches of government. These findings provide information on the behavior of stakeholders to policymakers and inform stakeholders about the type of information the Supreme Court considers in different phases when making policy.

A disheartening result from this dissertation is that expertise is employed more for its status than for the actual content it provides in policymaking. These findings alert scholars and science, technology, and innovation (STI) policymakers about the limited usage of expertise, which is often produced with public funds. In order for academic research to bring more significant and meaningful social and economic returns, a system should be developed that can incentivize policymakers to learn from expertise.

APPENDIX

A. eBay Inc. v. MercExchange, L.L.C., 547 U.S. 388, 2006

Concretely, the case starts from a failure to reach a licensing agreement on three patents owned by MercExchange and results into a lawsuit against eBay and two other online commerce firms. The question of injunction concerned the patent referred to as the "265 patent" (patent number 5,845,265) that protects a system for selling goods through an "electronic network of consignment stores". The U.S. District Court of the Eastern District of Virginia found that the 265 patent is valid, and eBay is infringing it, and therefore granted MercExchange $16 million in damages. However, the District Court denied MercExchange's request for permanent injunction on the grounds that: 1) discussions regarding licensing prior to the trial show that MercExchange was willing to license and 2) MercExchange does not practice the patent and, therefore, the damage can be calculated by estimating the licensing fee due. On appeal, the Court of Appeal for the Federal Circuit reversed the injunction decision. It found that: 1) the excludability is inherently tied to the concept of property and 2) based on a comparison with exceptional cases in which injunctions have not been granted, the Court of Appeal declares that this case does not fit the description of an exceptional case.

The Supreme Court ruled to overturn the decision of the C.A.F.C. and reject the request for permanent injunction. The final decision in favor of eBay means that injunctions are not automatic anymore in the case of a patent infringement from May 15th, 2006.

The change brought by the Supreme Court is the application of Section 283 of the Patent Act stating that Courts "may grant injunctions in accordance with the principles of equity to prevent the violation of any right secured by patent, on such terms as the court deems reasonable" by emphasizing more the proposition "in accordance with the principles of equity" whereas jurisprudence until then focused on "prevent[ing] the violation of any right secured by patent". As a result, the principle of equity is applied by the Supreme Court as it is in other

areas of the law by granting injunction if the party seeking a permanent injunction demonstrates the following four factors: 1) The patent owner has suffered irreparable harm; 2) The remedies available at law (such as money damages) are inadequate to compensate for that injury; 3) The balance of hardships between the parties warrant a remedy in equity; and 4) The public interest would not be disserved by an injunction.

In terms of enforcement of this policy change, according to Denicolò et al. (2008) and Poltorak and Lerner (2014), District Courts apply a simplified version of this four-factor test. The eBay case does not bring significant changes for: 1) an entity practicing the patent and competing with the infringer, 2) a research organization funded by royalties, 3) an entity in indirect competition with the infringer. This enforcement of the new rule seems to have the undesirable effect of favoring manufacturing licensee's over firms "with other kinds of legitimate business models, such as innovators with limited or no presence in downstream markets". Gupta and Kesan (2017) analyze patent disputes after the eBay case to find that permanent injunction grant rate dropped by 13% for non-practicing entities while it dropped by 5% for practicing entities. They find that this drop for non-practicing entities is largely due to individual inventors while patent holding companies are not affected differently compared to practicing companies. However, they find that the rate at which injunctions are sought decreases by 52% for practicing companies and by 86% for non-practicing companies.

B. Model selection – comparison with a count model approach

I test the appropriateness of using the number of patents granted in the U.S. as the dependent variable. The variance of the number of patents granted in the U.S. is over 50 times larger than the mean so there is over-dispersion. As a result, the negative binomial estimation method is more appropriate than the Poisson estimation. In addition, the number of granted patent in the U.S. is likely to be equal to zero for a significant number of observations. Therefore, I test whether a zero-inflated model would be more appropriate. First, a comparison of the mean

observed, and predicted counts shows that the maximum difference in predicting value 1 is 0.028 with a mean difference of 0.006 for the negative binomial estimation and the maximum difference is 0.061 with a mean difference of 0.012 for the zero-inflated negative binomial estimation. Based on this test, the negative binomial model is a better predictor. Second, using count-by-count information for counts from 0 to 9, based on the proportion of predictions based by the models for each value of the count variable I calculate the Pearson chi-square statistic[63]. Adding up the Pearson chi-square statistics for all counts for each of the models, I obtain 475.398 for the negative binomial mode and 916.385 for the zero-inflated negative binomial model. This indicates that the predicted proportions were much closer to the actual proportions for the negative binomial model. However, based on a third test using the Bayesian information criterion, the Akaike information criterion and the Vuong statistics support the zero-inflated negative binomial model over the negative binomial model (BIC = -2.6*10^5 dif = 3732.300 and AIC = 1.674 dif = 0.124 and Vuong = 27.504 prob = 0.000 p =0.000. strongly supports the zero-inflated negative binomial model). Overall, based on these three tests, I get inconsistent conclusions based on different criteria.

Given this inconclusive result, I choose to estimate the effect of eBay using the negative binomial model for its better compatibility with panel data analysis. I include the logarithm of the number of patent applications in France and constrain its coefficient to 1. Based on the Hausman test, I find that the use of fixed effects is more appropriate than random effects (chi-square(34) = 15,925; prob>chi2 = 0.0000) and year dummies are needed (chi-square(13)=484.47; prob>chi2=0.000). In computing the estimation, the log-likelihood function of the model does not converge and remains at the same value from the 13th iteration. Therefore, I restrict the number of iterations to 20 arbitrarily and report results about the effect of the eBay case on patenting propensity that are only approximate.

[63] Pearson stat = number of observations * (absolute difference)^2/ predicted for each of the counts.

Given the multiple issues related to the estimation using a negative binomial approach, I choose to report the main results using an Ordinary Least Square regression. Nevertheless, the count model shows consistent results in terms of direction and significance of the effects of the policy on the propensity to patent. In addition to those issues, to control for fixed effects, a Poisson model is more a more appropriate count model. Therefore, I also compute the results for this distribution controlling for fixed effect and find that the results are consistent.

Table 22 Effect of the eBay case on firms' propensity to patent – negative binomial

		All firms		Complex only	Small and Medium firms only
	(1)	(2)	(3)	(4)	(5)
Shock	-0.0829***	-0.0779***	-0.0569***	0.0514	-0.0239
	(0.019)	(0.024)	(0.022)	(0.051)	(0.040)
Complex		0.0431*			-0.0284
		(0.026)			(0.047)
Shock*Complex		-0.0304			0.0740
		(0.033)			(0.065)
Large&Complex			0.1528***		
			(0.029)		
Shock* Large&Complex			-0.1041***		
			(0.034)		
Large		0.2542***		0.3685***	0.0883***
		(0.033)		(0.054)	(0.011)
Shock* Large				-0.2347***	0.1233***
				(0.059)	(0.036)
R&D intensity	0.0220	0.0939***	0.0993***	0.1047***	2.5939***
	(0.014)	(0.009)	(0.009)	(0.014)	(0.068)
Group		0.0900***	0.1237***	0.0935**	0.0954***
		(0.029)	(0.028)	(0.044)	(0.036)
International	1.5835***	2.2137***	2.2211***	2.0151***	0.0883***
	(0.073)	(0.055)	(0.054)	(0.085)	(0.011)
Competition	-0.1526***	-0.0963***	-0.0777***	-0.0802***	0.1233***
	(0.016)	(0.014)	(0.014)	(0.019)	(0.036)
Firm FE	Yes	No	No	No	No
Industry FE	No	Yes	Yes	Yes	Yes
Constant	15.6342	14.8248***	12.9673	14.8289***	13.2526***
	(162.683)	(0.132)	(54.067)	(0.238)	(0.174)
Observations	6,428	14,590	14,590	5,728	12,201
# of firms	1,545	7,633	7,633	3,410	7,067
Wald chi2	618.97	2472.69	2441.92	982.38	1936.21
Log likelihood	-4684.9407	-10710.588	-10727.75	-4426.4056	-7054.2246
Prob > stat	0.0000	0.0000	0.0000	0.0000	0.0000

Note: * significant at 0.10, ** significant at 0.05, *** significant at 0.01. Standard errors are in parenthesis.

Table 23 Effect of the eBay case on firms' propensity to patent – Poisson

		All firms		Complex only	Small and Medium firms only
	(1)	(2)	(3)	(4)	(5)
Shock	-0.0829***	-0.0779***	-0.0569***	0.0514	-0.0239
	(0.019)	(0.024)	(0.022)	(0.051)	(0.040)
Complex		0.0431*			-0.0284
		(0.026)			(0.047)
Shock*Complex		-0.0304			0.0740
		(0.033)			(0.065)
Large&Complex			0.1528***		
			(0.029)		
Shock* Large&Complex			-0.1041***		
			(0.034)		
Large		0.2542***		0.36849***	
		(0.033)		(0.054)	
Shock* Large				-0.23472***	
				(0.059)	
R&D intensity	0.0220	0.0939***	0.0993***	0.1047***	0.0883***
	(0.014)	(0.009)	(0.009)	(0.014)	(0.011)
Group		0.0900***	0.1237***	0.0935**	0.1233***
		(0.029)	(0.028)	(0.044)	(0.036)
International	1.5835***	2.2137***	2.2211***	2.0151***	2.5939***
	(0.073)	(0.055)	(0.054)	(0.085)	(0.068)
Competition	-0.1526***	-0.0963***	-0.0777***	-0.0802***	0.0954***
	(0.016)	(0.014)	(0.014)	(0.019)	(0.036)
Firm FE	Yes	No	No	No	No
Industry FE	No	Yes	Yes	Yes	Yes
Constant alpha		-1.9181***	-1.8810***	-1.7046***	-2.0943***
		(0.091)	(0.091)	(0.127)	(0.141)
Constant		-2.3223***	-2.3351***	-2.0463***	-2.4527***
		(0.097)	(0.097)	(0.200)	(0.104)
Observations	6,428	14,590	14,590	5,728	12,201
# of firms	1,545	7,633	7,633	3,410	7,067
Wald chi2	618.97	2472.69	2441.92	982.38	1936.21
Log likelihood	-4684.9408	-10710.595	-10727.75	-4426.4078	-7054.2262
Prob > stat	0.0000	0.0000	0.0000	0.0000	0.0000

Note: * significant at 0.10, ** significant at 0.05, *** significant at 0.01. Standard errors are in parenthesis.

C. Main models accounting for time trends

To account for time trends, I use year dummies. As mentioned above, in this model, there can be concerns that the year dummies interact with the policy variable. Nevertheless, I observe that the result is consistent when attempting to capture for time trends. The size of the negative

effect is stronger, which is consistent with the observation that overall the average proportion of French patents also filed in the U.S. decreases.

Table 24 Effect of the eBay case on firms' propensity to patent with year dummies

OLS	Patenting Propensity			R&D intensity		
	(1)	(2)	(3)	(4)	(5)	(6)
Shock	-0.0787***	-0.0811***	-0.0744***	0.4245***	0.2575***	0.3135***
	(0.010)	(0.008)	(0.007)	(0.090)	(0.074)	(0.071)
Complex		-0.0085**			0.0116	
		(0.004)			(0.049)	
Shock*Complex		0.0144**			0.0509	
		(0.006)			(0.066)	
Large&Complex			0.0437***			0.1165**
			(0.008)			(0.052)
Shock*						
Large&Complex			-0.0230*			-0.1403**
			(0.013)			(0.063)
Large		0.0415***			0.1592***	
		(0.005)			(0.048)	
R&D intensity	0.0013	0.0208***	0.0217***			
	(0.002)	(0.002)	(0.002)			
Group		-0.0021	-0.0001		0.5244***	0.5283***
		(0.003)	(0.003)		(0.022)	(0.022)
International	0.4609***	0.5919***	0.5976***	-0.0630	0.1908***	0.2008***
	(0.014)	(0.011)	(0.010)	(0.104)	(0.052)	(0.052)
Competition	-0.0057	0.0078*	0.0119***	0.0133	0.1818**	0.1840**
	(0.004)	(0.005)	(0.004)	(0.038)	(0.085)	(0.086)
R&D intensity t-1				0.2497***	0.527***	0.1224***
				(0.034)	(0.022)	(0.030)
Firm FE	Yes	No	No	Yes	No	No
Industry FE	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.1363***	0.0945***	0.0919***	1.2705***	0.3949***	0.3986***
	(0.007)	(0.010)	(0.010)	(0.090)	(0.150)	(0.149)
Obs	23,132	23,132	23,132	3,991	3,991	3,991
# firms	10,688	10,688	10,688	1,418	1,418	1,418
R-squared	0.15014	0.3036	0.3015	0.5387	0.5947	0.5951
Prob > stat	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: * significant at 0.10, ** significant at 0.05, *** significant at 0.01. Standard errors are in parenthesis.

D. French firms' propensity to patent in South Korea, Taiwan and the United Kingdom

Table 25 Effect of an event in 2006 on firms' propensity to patent

Patenting propensity	in South Korea	in South Korea	in Taiwan	in Taiwan	in the United Kingdom	in the United Kingdom
	(1)	(2)	(3)	(4)	(5)	(6)
Shock	-0.0033**	0.0003	-0.0027***	-0.0016***	-0.0103***	-0.0127***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Large&Complex		0.0020		0.0055***		-0.0153***
		(0.002)		(0.002)		(0.004)
Shock* Large&Complex		-0.0052		-0.0065***		0.0009
		(0.004)		(0.002)		(0.005)
R&D intensity	0.0005	0.0012**	-0.0002	0.0001	0.0008	0.0036***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
International	0.0953***	0.0023***	0.0057**	0.0008	0.1446***	-0.0038**
	(0.008)	(0.001)	(0.003)	(0.001)	(0.008)	(0.002)
Competition	0.0025	0.1097***	0.0001	0.0063**	0.0028	0.1512***
	(0.002)	(0.007)	(0.001)	(0.003)	(0.003)	(0.007)
Firm FE	Yes	No	Yes	No	Yes	No
Industry FE	No	Yes	No	Yes	No	Yes
Constant	0.0029***	0.0052	0.0044***	0.0005	0.0105***	0.0087**
	(0.001)	(0.003)	(0.001)	(0.001)	(0.002)	(0.004)
Observations	23,132	23,132	23,132	23,132	23,132	23,132
R-squared	0.05106	0.0970	0.00089	0.0040	0.07015	0.0775
# of firm	10,688	10,688	10,688	10,688	10,688	10,688

Note: * significant at 0.10, ** significant at 0.05, *** significant at 0.01. Standard errors are in parenthesis.

E. The potential effect of the 2008 crisis

I introduce a dummy equal to 1 from 2008 to account for the potential effect of the crisis. Because of collinearity issues, I remove the year dummies. The estimation results show that the direction and significant of the effect of the policy remain consistent. The size of the effect is diminished. However, given than both the policy dummy and the 2008 crisis dummy are equal to 1 over the period 2008-2010 with no way of distinguishing the effects, the size of the coefficients cannot be interpreted. Based on the weakly significant negative effect of the 2008 crisis, the strong significance of the negative effect of the policy on patenting and the positive effect of the policy on R&D intensity, I can conclude that while the effect of the policy in the

main model might be smaller, this robustness check shows that the effect of the 2008 crisis does not change the conclusions of the study.

Table 26 Effect of the eBay case on firms' propensity to patent

OLS	Patenting Propensity			R&D intensity		
	(1)	(2)	(3)	(4)	(5)	(6)
Shock	-0.01541**	-0.02942***	-0.02211***	0.23959***	0.12690***	0.18044***
	(0.006)	(0.005)	(0.005)	(0.055)	(0.057)	(0.053)
Complex		-0.00805**			0.01422	
		(0.004)			(0.049)	
Shock*Complex		0.01448**			0.05903	
		(0.006)			(0.066)	
Large&Complex			0.04667***			0.12335**
			(0.008)			(0.052)
Shock* Large&Complex			-0.02487*			-0.13382**
			(0.013)			(0.063)
Large		0.04351***			0.16156***	
		(0.005)			(0.048)	
Crisis (=1 from 2008)	-0.01105*	-0.00449	-0.00481	0.03659	0.04164	0.04279
	(0.007)	(0.005)	(0.005)	(0.050)	(0.052)	(0.052)
R&D intensity	-0.00032	0.02004***	0.02105***			
	(0.002)	(0.002)	(0.002)			
Group		0.00751**	0.00962***		0.15367***	0.16106***
		(0.003)	(0.003)		(0.045)	(0.045)
International	0.44836***	0.58213***	0.58793***	-0.02078	0.17859**	0.17780**
	(0.014)	(0.011)	(0.011)	(0.104)	(0.084)	(0.085)
Competition	-0.01433***	0.00266	0.00695	0.03529	0.11094***	0.12376***
	(0.004)	(0.005)	(0.004)	(0.037)	(0.029)	(0.029)
R&D intensity t-1				0.25467***	0.52640***	0.53010***
				(0.035)	(0.022)	(0.022)
Firm FE	Yes	No	No	Yes	No	No
Industry FE	No	Yes	Yes	No	Yes	Yes
Constant	0.11417***	0.06178***	0.05913***	1.31023***	0.39320***	0.39769***
	(0.003)	(0.009)	(0.009)	(0.070)	(0.142)	(0.141)
Obs	23,132	23,132	23,132	3,991	3,991	3,991
R-squared	0.13548	0.2937	0.2916	0.5569	0.5922	0.5924
# firms	10,688	10,688	10,688	1,418	1,418	1,418
Prob > stat	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: * significant at 0.10, ** significant at 0.05, *** significant at 0.01. Standard errors are in parenthesis.

F. Accounting for firm diversification

Because firms can diversify in various technology area, the industry code may not be capturing the effect of the policy in complex product industries and discrete product industries with precision. The sample includes a significant number of large firms that are more prone to diversifying. Therefore, I isolate for each firm, the patents that are part of an undisputed complex product industry (electrical engineering) and patents that are part of undisputed discrete product industries (pharmaceuticals, chemicals and biotechnology) based on their International Patent Classification (IPC) codes. The results show that the effect of the policy is negative and significant in both types of industries, consistently with the main model.

Table 27 Effect of the eBay case on firms' propensity for their patents in complex product technology fields

OLS	**Patenting Propensity**		
	(1)	**(2)**	**(3)**
Shock	-0.02049***	-0.04206***	-0.02237***
	(0.007)	(0.010)	(0.005)
Complex		-0.03758***	
		(0.006)	
Shock*Complex		0.02493**	
		(0.011)	
Large&Complex			0.04335***
			(0.008)
Shock* Large&Complex			-0.02120
			(0.014)
Large		0.04055***	
		(0.007)	
R&D intensity	0.00508	0.02022***	0.02102***
	(0.003)	(0.002)	(0.002)
Group		-0.00071	0.00043
		(0.005)	(0.005)
International	0.36468***	0.49575***	0.50803***
	(0.021)	(0.016)	(0.016)
Competition	-0.02427***	0.00028	0.00332
	(0.006)	(0.005)	(0.005)
Firm FE	Yes	No	No
Industry FE	No	Yes	Yes
Constant	0.12634***	0.11433***	0.09146***
	(0.004)	(0.018)	(0.018)
Obs	12,927	12,927	12,927
R-squared	0.1626	0.2067	0.2033
# firms	6,427	6,427	6,427
Prob > stat	0.0000	0.0000	0.0000

Note: * significant at 0.10, ** significant at 0.05, *** significant at 0.01. Standard errors are in parenthesis.

G. Anticipation effect

The law suit starts in 2002 and the first controversial decision to deny permanent injunction despite the infringement of a valid patent is made in 2003. To account for the possibility that market entities had perceived this case as having the potential to change the long-standing rule about excludability, I control for the anticipation effect or uncertainty regarding the decision between 2003 and the final decision in 2006. I modify the policy dummy to be missing. The result of the estimation shows that the significance and direction of the effect of the policy on patenting propensity remains unchanged and is consistent the main findings of the study.

Table 28 Effect of weakening patents on firms' propensity to patent and R&D intensity accounting for potential anticipation effects

OLS	**Patenting Propensity**			**R&D intensity**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Shock	-0.04505***	-0.04925***	-0.04139***	0.36746***	0.19347***	0.25428***
	(0.006)	(0.004)	(0.004)	(0.061)	(0.051)	(0.044)
Complex		-0.01124**			0.00260	
		(0.005)			(0.062)	
Shock*Complex		0.01662**			0.04553	
		(0.007)			(0.075)	
Large&Complex			0.04543***			0.17338***
			(0.009)			(0.063)
Shock* Large&Complex			-0.02646*			-0.20363***
			(0.015)			(0.073)
Large		0.04016***			0.17458***	
		(0.006)			(0.051)	
R&D intensity	-0.00119	0.02193***	0.02288***			
	(0.002)	(0.002)	(0.002)			
Group		0.00215	0.00362		0.17626***	0.18380***
		(0.004)	(0.004)		(0.046)	(0.046)
International	0.46093***	0.59134***	0.59701***	0.01805	0.14786	0.15474
	(0.017)	(0.012)	(0.012)	(0.126)	(0.098)	(0.098)
Competition	-0.01079**	0.00498	0.00887*	0.00192	0.11690***	0.13450***
	(0.005)	(0.005)	(0.005)	(0.046)	(0.033)	(0.032)
R&D intensity t-1				0.25307**	0.55220**	0.55688**

				*	*	*
				(0.037)	(0.023)	(0.023)
Firm FE	Yes	No	No	Yes	No	No
Industry FE	No	Yes	Yes	No	Yes	Yes
Constant	0.12838***	0.07513***	0.07201** *	1.24645** *	0.26397*	0.26178*
	(0.003)	(0.010)	(0.010)	(0.076)	(0.145)	(0.144)
Obs	18,158	18,158	18,158	3,126	3,126	3,126
# firms	0.2349	0.2900	0.2881	0.5217	0.5972	0.5971
R-squared	9,286	9,286	9,286	1,269	1,269	1,269
Prob > stat	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: * significant at 0.10, ** significant at 0.05, *** significant at 0.01. Standard errors are in parenthesis.

H. Agenda setting: cases that petitioned the Supreme Court in the Case Study (N=14)

List of patent infringement cases (section "1862 Injunctions" in the West Key number System in Westlaw) appealed at the CAFC, in which the question treated by the court had to do with the conditions under which an injunction should be granted restricting the data set to 37 cases using the keyword "injunction" over the period 2000-2012.

Table 29 List of patent infringement cases decided at the CAFC on conditions for granting an injunction

Title	Citation	Date	Document Preview
MercExchange L.L.C. v. eBay Inc.	401 F.3d 1323	16-Mar-05	PATENTS - Injunction. Generally applicable four-factor test for permanent injunctive relief applies to disputes arising under Patent Act.
i4i Ltd. Partnership v. Microsoft Corp.	598 F.3d 831	10-Mar-10	PATENTS - Computers and Electronics. Sufficient evidence supported finding that patent relating to an invention for editing computer language was infringed.
Fuji Photo Film Co., Ltd. v. Jazz Photo Corp.	264 F.3d 1094	21-Aug-01	PATENTS - Consumer Goods. Only some imports of refurbished disposable cameras infringed patents.
Mallinckrodt, Inc. v. Masimo Corp.	147 Fed.Appx. 158	07-Sep-05	PATENTS - Injunction. District court's decision not to enter injunction for manufacturer's infringement of patent was abuse of discretion.
Glenayre Electronics, Inc. v. Jackson	443 F.3d 851	11-Apr-06	PATENTS - Damages. Patentee's acceptance of remitted damages award on direct infringement claim barred second trial on indirect infringement.
Monsanto Co. v. McFarling	488 F.3d 973	24-May-07	PATENTS - Damages. Evidence supported $375,000 damage award to owner of patents for herbicide-resistant soybean seeds.
Abbott Laboratories v. TorPharm, Inc.	503 F.3d 1372	11-Oct-07	PATENTS - Injunction. Injunction did not bar filing of repetitive ANDA, precluding finding that manufacturer was in contempt.
Amado v. Microsoft Corp.	517 F.3d 1353	26-Feb-08	PATENTS - Injunction. Mandate rule did not preclude district court from reconsidering prospective application of permanent injunction on remand.
Fresenius USA, Inc. v. Baxter Intern., Inc.	582 F.3d 1288	10-Sep-09	PATENTS - Medical Devices and Procedures. Addition of a touch screen to a hemodialysis machine was obvious.
Streck, Inc. v. Research & Diagnostic Systems, Inc.	665 F.3d 1269	10-Jan-12	PATENTS - Medical Devices and Procedures. Patents for hematology control technology provided adequate written description.
Edwards Lifesciences AG v. CoreValve, Inc.	699 F.3d 1305	13-Nov-12	PATENTS - Attorney Fees. Decision to not enhance damages or award attorney fees after verdict of willful infringement was not abuse of discretion.
ePlus, Inc. v. Lawson Software, Inc.	700 F.3d 509	21-Nov-12	PATENTS - Computers and Electronics. System claims were invalid as indefinite even if implementing that functionality already was known prior to patent.
Presidio Components, Inc. v. American Technical Ceramics Corp.	702 F.3d 1351	19-Dec-12	PATENTS - Injunction. District court clearly erred in finding no irreparable injury to patentee as result of competitor's infringement.
EchoStar Communications Corp. v. TiVo, Inc.	646 F.3d 869	09-Sep-08	

Source: Westlaw, blue= granted *certiorari*, red= denied *certiorari*

Table 30 Stakeholders in patent infringement cases decided at the CAFC and petitioning the Supreme Court on conditions for granting an injunction

Supreme Court docket number	Petitioner	Amicus briefs for petitioner	Respondent	Amicus briefs for respondent	Amicus briefs neither side
05-130	eBay	5	MercExchange	1	0
10-290	MICROSOFT CORPORATION	11	i4i Ltd. Partnership	0	0
01-1376	JAZZ PHOTO CORPORATION and DYNATEC INTERNATIONAL, INC.	3	Fuji Photo Film Co., Ltd. And ITC	0	1
05-924	MALLINCKRODT INC. and Nellcor Puritan Bennett, Inc.	0	Masimo Corp	0	0
06-326	Jackson	0	GLENAYRE ELECTRONICS, INC.	0	0
07-241	McFarling	1	Monsanto Corp	0	0
07-912	APOTEX, INC. and Apotex Corporation	0	Abbott Laboratories	0	0
06-604	MICROSOFT CORPORATION	0	Amado	0	0
13-1071	BAXTER INTERNATIONAL INC. and Baxter Healthcare Corporation	4	Fresenius USA, Inc.	0	0
11-1212	RESEARCH & DIAGNOSTIC SYSTEMS, INC. and Techne Corporation	0	Streck, Inc.	0	0
12-1325	EDWARDS LIFESCIENCES AG and Edwards Lifesciences LLC	2	Corevalve	0	0
15-639	EPLUS Inc.	1	Lawson Software, Inc.	0	0
17-1649	Presidio Components Inc	0	American Technical Ceramics Corp.	0	0

I. Policymaking: Patent-related Cases at the Supreme Court, 2000-2015

Table 31 List of all patent-related Cases at the Supreme Court, 2000-2015 (N=31)

Case number	Title	Year	Patentability	Breadth	Exclusivity	Other	# Amicus briefs
99-1996	J.E.M. Ag Supply, Inc. v. Pioneer Hi-Bred Intern., Inc.	2001	0	0	0	0	13
00-1543	Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., Ltd.	2002	1	1	1	0	40
01-408	Holmes Group, Inc. v. Vornado Air Circulation Systems, Inc.	2002	1	0	1	0	1
03-1237	Merck KGaA v. Integra Lifesciences I, Ltd.	2005	1	1	1	0	20
05-130	eBay Inc. v. MercExchange, L.L.C.	2006	1	0	1	0	37
04-1329	Illinois Tool Works Inc. v. Independent Ink, Inc.	2006	1	0	1	0	20
04-1350	KSR Intern. Co. v. Teleflex Inc.	2007	1	0	0	0	41
05-608	MedImmune, Inc. v. Genentech, Inc.	2007	1	0	1	0	17
05-1056	Microsoft Corp. v. AT & T Corp.	2007	0	0	1	0	20
06-937	Quanta Computer, Inc. v. LG Electronics, Inc.	2008	0	0	1	0	31
07-1437	Carlsbad Technology, Inc. v. HIF Bio, Inc.	2009	1	0	0	1	0
08-964	Bilski v. Kappos	2010	0	0	0	0	75
09-1159	Board of Trustees of Leland Stanford Junior University v. Roche Molecular Systems, Inc.	2011	0	0	0	1	16
10-6	Global-Tech Appliances, Inc. v. SEB S.A.	2011	0	0	1	0	14
10-290	Microsoft Corp. v. I4I Ltd. Partnership	2011	0	0	1	0	62

10-844	Caraco Pharmaceutical Laboratories, Ltd. v. Novo Nordisk A/S	2012	1	0	1	0	13
10-1219	Kappos v. Hyatt	2012	1	0	0	1	6
10-1150	Mayo Collaborative Services v. Prometheus Laboratories, Inc.	2012	0	0	0	0	29
12-398	Association for Molecular Pathology v. Myriad Genetics, Inc.	2013	0	0	0	0	56
11-796	Bowman v. Monsanto Co.	2013	0	0	1	0	23
12-416	F.T.C. v. Actavis, Inc.	2013	1	0	1	0	27
11-1118	Gunn v. Minton	2013	1	0	0	1	6
13-298	Alice Corp. Pty. Ltd. v. CLS Bank Intern.	2014	0	0	0	0	51
12-1163	Highmark Inc. v. Allcare Health Management System, Inc.	2014	1	0	1	0	10
12-786	Limelight Networks, Inc. v. Akamai Technologies, Inc.	2014	1	0	1	0	25
12-1128	Medtronic, Inc. v. Mirowski Family Ventures, LLC	2014	0	0	1	0	
13-369	Nautilus, Inc. v. Biosig Instruments, Inc.	2014	0	0			
12-1184	Octane Fitness, LLC v. ICON Health & Fitness, Inc.	2014	0	0			
13-854	Teva Pharmaceuticals USA, Inc. v. Sandoz, Inc.	2015	0	1			
13-896	Commil USA, LLC v. Cisco Systems, Inc.	2015	0	0			
13-720	Kimble v. Marvel Entertainment, LLC	2015	0	0			

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